Comprehensive Stormwater Management Plan

Lower Merion Township
75 East Lancaster Avenue
Ardmore, PA 19003

July 2018

Prepared by: Wood Environment & Infrastructure Solutions, Blue Bell, PA
# Lower Merion Township Comprehensive Stormwater Management Plan

## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronyms and Abbreviations</td>
<td>i</td>
</tr>
<tr>
<td>Glossary of Terms</td>
<td>ii</td>
</tr>
<tr>
<td>1.0 Executive Summary</td>
<td>1-1</td>
</tr>
<tr>
<td>2.0 Stormwater Planning</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1 Water Services Overview</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2 Stormwater Plan Data Collection Method</td>
<td>2-5</td>
</tr>
<tr>
<td>2.3 Trends toward Green Stormwater Infrastructure</td>
<td>2-6</td>
</tr>
<tr>
<td>2.4 Trends in Municipal Street Sweeping</td>
<td>2-8</td>
</tr>
<tr>
<td>3.0 Current Stormwater Management Program</td>
<td>3-1</td>
</tr>
<tr>
<td>3.1 Township Stormwater Drivers</td>
<td>3-1</td>
</tr>
<tr>
<td>3.2 Limits of Township Authority</td>
<td>3-4</td>
</tr>
<tr>
<td>3.3 Current Stormwater Services</td>
<td>3-5</td>
</tr>
<tr>
<td>3.4 Estimated Cost of Current Services</td>
<td>3-7</td>
</tr>
<tr>
<td>4.0 Stormwater Program Gaps</td>
<td>4-1</td>
</tr>
<tr>
<td>5.0 Stormwater Program Recommendations</td>
<td>5-1</td>
</tr>
<tr>
<td>5.1 Guiding Strategies</td>
<td>5-1</td>
</tr>
<tr>
<td>5.2 Summary of Recommended Projects/Activities</td>
<td>5-2</td>
</tr>
<tr>
<td>5.3 Recommended Projects and Activities by Cost Center</td>
<td>5-4</td>
</tr>
<tr>
<td>6.0 Program Timeline and Cost Assumptions</td>
<td>6-1</td>
</tr>
<tr>
<td>6.1 Program Management Strategy</td>
<td>6-1</td>
</tr>
<tr>
<td>6.2 Pace of Program Change</td>
<td>6-2</td>
</tr>
<tr>
<td>6.3 Program Cost Projection</td>
<td>6-4</td>
</tr>
<tr>
<td>7.0 Funding &amp; Implementation Options Analysis</td>
<td>7-1</td>
</tr>
<tr>
<td>7.1 Introduction</td>
<td>7-1</td>
</tr>
<tr>
<td>7.2 Stormwater Partnership and Funding Strategies</td>
<td>7-1</td>
</tr>
<tr>
<td>7.3 Primary Methods of Funding a Stormwater Program</td>
<td>7-3</td>
</tr>
<tr>
<td>7.4 Stormwater Program Funding Discussion</td>
<td>7-6</td>
</tr>
</tbody>
</table>

## Appendices

<table>
<thead>
<tr>
<th>Appendix A</th>
<th>Select Project Background Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix B</td>
<td>Public Presentations and Notes</td>
</tr>
</tbody>
</table>
# ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act 167</td>
<td>Pennsylvania Stormwater Management Act of 1978</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practice</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GSI</td>
<td>Green Stormwater Infrastructure</td>
</tr>
<tr>
<td>IA</td>
<td>Impervious Area</td>
</tr>
<tr>
<td>IDD&amp;E</td>
<td>Illicit Discharge Detection and Elimination</td>
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<tr>
<td>LID</td>
<td>Low Impact Development</td>
</tr>
<tr>
<td>LMC</td>
<td>Lower Merion Conservancy</td>
</tr>
<tr>
<td>MCCD</td>
<td>Montgomery County Conservation District</td>
</tr>
<tr>
<td>MCM</td>
<td>Minimum Control Measure</td>
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<td>MS4</td>
<td>Municipal Separate Storm Sewer System</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>PADEP</td>
<td>Pennsylvania Department of Environmental Protection</td>
</tr>
<tr>
<td>PAG-13</td>
<td>General Permit for Stormwater Discharges from Small MS4s</td>
</tr>
<tr>
<td>PCB</td>
<td>Polychlorinated Biphenyl</td>
</tr>
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<td>PCSM</td>
<td>Post-Construction Stormwater Management</td>
</tr>
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<td>PennDOT</td>
<td>Pennsylvania Department of Transportation</td>
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<td>PEOP</td>
<td>Public Education and Outreach Program</td>
</tr>
<tr>
<td>PFC</td>
<td>Perfluorinated Chemicals</td>
</tr>
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<td>PIPP</td>
<td>Public Involvement and Participation Program</td>
</tr>
<tr>
<td>SALDO</td>
<td>Subdivision and Land Development Ordinance</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Maximum Daily Load</td>
</tr>
<tr>
<td>TSF</td>
<td>Trout Stocking Fishery</td>
</tr>
<tr>
<td>TSS</td>
<td>Total Suspended Solids</td>
</tr>
<tr>
<td>UA</td>
<td>Urbanized Area</td>
</tr>
<tr>
<td>USACE</td>
<td>US Army Corps of Engineers</td>
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<td>USEPA</td>
<td>US Environmental Protection Agency</td>
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<td>WWF</td>
<td>Warm Water Fishery</td>
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</tbody>
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GLOSSARY OF TERMS

303(d) List: A listing of a state’s impaired and threatened waters (e.g. stream/river segments, lakes). States are required to submit their list for EPA approval every two years. For each water on the list, the state identifies the pollutant causing the impairment, when known. (USEPA)

Attaining Stream: Streams and bodies of water that are meeting their designated and existing uses. (PADEP)

Best Management Practice (BMP):
Any man-made structure that is designed and constructed to convey, store, detain, infiltrate, or otherwise control stormwater runoff quality, rate, or quantity. (PA BMP Manual)

Stormwater structures and facilities designed or used to maintain or improve the water quality of surface runoff. BMP’s may be structural (basins or seepage pits), nonstructural (vegetative filter strips and buffers) or managerial techniques (maintenance practices) that may be used singly or in combination to achieve water quality improvements. (Lower Merion Chapter 121: Stormwater Management and Erosion Control)

Bioretention/Rain Garden: An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. (PADEP BMP Effectiveness Values)

Clean Water Act: The Clean Water act established the basic structure for regulating pollutant discharges into the waters of the United States, gave the EPA authority to implement pollution control programs, maintained existing water quality standard requirements, funded the construction of sewage treatment plants, and recognized the need for planning to address problem posed by nonpoint source pollution. (USEPA)

Designated Use: The main purpose of a stream or water body. Designated uses include: aquatic life, fish consumption, recreation, or potable water supply. (PADEP)

Dry Detention Basin: Depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. (PADEP BMP Effectiveness Values)

Evapotranspiration: The combined effort of evaporation and transpiration to remove water from the soil and vegetation. (Villanova Urban Stormwater Partnership)

General Permit PAG-13: PAG-13 addresses stormwater discharges from certain small MS4s. It provides a streamlined process to meet the federal requirements. In some cases, such as a municipality that is not eligible for general permit coverage because it discharges to a special protection watershed, an Individual NPDES MS4 Permit is needed. (PADEP)

Green Roof: An alternative to traditional impervious roof surfaces. They typically consist of underlying waterproofing and drainage materials and an overlying engineered growing media that is designed to support plant growth. Stormwater runoff is captured and temporarily stored in the engineered
Growing media, where it is subjected to the hydrologic processes of evaporation and transpiration, with any excess runoff conveyed back into the storm drain system. This allows green roofs to provide measurable reductions in post-construction stormwater runoff rates, volumes, and pollutant loads on development sites. (PADEP BMP Effectiveness Values)

**Green Stormwater Infrastructure (GSI):** A term used to characterize the role of natural system elements in preventing stormwater generation, infiltrating stormwater once it’s created, and then conveying and removing pollutants from stormwater flows. (PA BMP Manual)

**Grey Infrastructure:** Conventional piped drainage and water treatment systems (i.e. curbs, gutters, drains, piping, and collection systems) designed to move urban stormwater away from the built environment. (USEPA)

**Illicit Discharge:** Any discharge to an MS4 that is not composed entirely of stormwater with some exceptions, such as discharges from NPDES-permitted industrial sources and discharges from fire-fighting activities. Illicit discharges are considered “illicit” because MS4s are not designed to accept, process, or discharge such non-stormwater wastes. (USEPA)

**Illicit Discharge Detection and Elimination (IDD&E):** One of six measures the operator of a MS4 is required to include in its stormwater management program to meet the conditions of its NPDES permit. (USEPA)

**Impaired Stream:** Streams and bodies of water that are not attaining designated and existing uses. (PADEP)

**Impervious Area:** Any material placed on or above the earth, the artificial impacting of the earth, or any material change in the natural surface of the earth which substantially reduces or prevents the natural percolation of water or which reduces the undisturbed open space areas on a lot. Examples include but are not limited to structures, including eaves, roofs and roof overhangs; parking areas (whether hard-surfaced or not); driveways; sidewalks; patios and decks; sport courts; and pools. The following shall not be considered as impervious surface:

1. Wood decks less than 200 square feet if constructed with a space between each plank and if the deck is constructed over a pervious surface. One-half of the area of such wood decks exceeding 200 square feet shall be considered impervious surface.

2. Pathways six feet or less in width that employ grass pavers or porous paving and which are not intended for automobile use. (Lower Merion Chapter 155: Zoning)

**Low Impact Development (LID):** Site design approaches and small-scale stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. LID can be applied to new development, urban retrofits, and revitalization projects. LID utilizes design techniques that infiltrate, filter, evaporate, and store runoff close to its source. Rather than rely on costly largescale conveyance and treatment systems, LID addresses stormwater through a variety of small, cost-effective landscape features located on-site. (PA BMP Manual)

**Lower Merion Storm Water Management Evaluation Task Force (Task Force):** A group created by the Lower Merion Board of Commissioners consisting of representatives from several Township advisory committees, the Federation of Civic Associations, the commercial community, several institutions, and the Lower Merion Conservancy. The Task Force was assigned to evaluate the sufficiency of the Township’s current stormwater management program and the appropriate steps forward. (Report of the Lower Merion Storm Water Management Evaluation Task Force)

**Minimum Control Measure (MCM):** Six topics listed in the PAG-13 MS4 General Permit and MS4 Individual Permit which must be addressed in MS4 permittee’s Stormwater Management Programs. These measures are: public education and outreach on stormwater impacts, public involvement/participation, illicit discharge detection and elimination (IDD&E), construction site stormwater runoff control, post-construction stormwater management (PCSM), and pollution prevention/good housekeeping. (PADEP)
Montgomery County Conservation District (MCCD): An organization with the mission to protect and improve the quality of life of the residents of Montgomery County and surrounding communities by providing, in cooperation of others, timely and efficient service, education, and technical guidance regarding the use of the County's natural resources. (MCCD)

National Pollutant Discharge Elimination System (NPDES): The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Created in 1972 by the Clean Water Act, the NPDES permit program is authorized to state governments by EPA to perform many permitting, administrative, and enforcement aspects of the program. (USEPA)

Pollutant Reduction Plan (PRP): Outline how the MS4 will reduce the pollutant loads going into a waterway. Any MS4 that discharges nutrients and sediment to waters in the Chesapeake Bay watershed or to a waterways subject to an impairment must submit a PRP with their permit application, or receive a waiver from the PADEP. (PADEP)

Post-Construction Stormwater Management (PCSM): One of six measures the operator of a MS4 is required to include in its stormwater management program to meet the conditions of its NPDES permit. Post-construction stormwater management in areas undergoing new development or redevelopment is necessary because runoff from these areas has been shown to significantly affect receiving waterbodies. (USEPA)

Rain Garden: A bioretention area or rain garden is a shallow surface depression designed to accept runoff from adjacent surfaces and retain or detain stormwater before it is infiltrated or discharged downstream, planted with specially selected native vegetation to capture and treat runoff. (Lower Merion Chapter 155: Zoning)

Stormwater Management Act of 1978 (Act 167): Required that within two years following the promulgation of guidelines by DEP, each county must prepare and adopt a watershed stormwater management plan for each watershed located in the county as designated by DEP, in consultation with the municipalities located within each watershed, and must periodically review and revise such plans at least every five years. (PADEP)

Total Maximum Daily Load (TMDL): The calculation of the maximum amount of pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant. (USEPA)

Total Suspended Solids (TSS): A measure of the filterable matter in a water sample. (PA BMP Manual)

Vegetated Swale: a broad, shallow, trapezoidal or parabolic channel, densely planted with a variety of trees, shrubs, and/or grasses. It is designed to attenuate and in some cases infiltrate runoff volume from adjacent impervious surfaces, allowing some pollutants to settle out in the process. (PA Stormwater BMP Manual)

Watercourse: Any natural or artificial swale, stream, channel, drain or culvert in which waters flow continuously or intermittently. (Lower Merion Chapter 135: Subdivision and Land Development)
1.0 EXECUTIVE SUMMARY

The stormwater management responsibilities of municipal governments continue to grow in Pennsylvania and across the Mid-Atlantic region. Water quality regulations, residents’ expectations, the cost of operating storm sewers, and the frequency of flooding events are all increasing. These challenges are driving municipalities to adapt by coordinating stormwater management into a more formalized program of services.

Lower Merion’s 2016 Comprehensive Plan recommends developing a stormwater strategy to guide the Township as it adapts its services to address these mounting stormwater challenges. Specifically, Recommendation W8 within the Water Resources Element of the Comprehensive Plan states the stormwater plan should “guide the development and implementation of innovative methods to efficiently and economically manage municipal stormwater”.

Municipalities are finding that such a coordinated, long-term stormwater management strategy can provide more proactive and cost-effective services. These stormwater programs include a set of multi-disciplinary activities that go far beyond the traditional storm sewer maintenance services performed by Public Works. Instead, a comprehensive stormwater program includes public education, land development plan negotiation, watershed modeling, and coordination with private property owners and regional partners on water quality initiatives.

Just as Lower Merion maintains a long-range approach to managing its sanitary sewer conveyance network, this Comprehensive Stormwater Management Plan recommends investment in surface water management, protection, and treatment over the next ten years. Section 4 identifies a series of gaps stormwater program areas that require Township resources to support either a new stormwater management service or an expansion to an existing service. Specifically, Section 5 lays out 22 specific recommended stormwater activities and projects the Township should implement. Section 6 presents the following three stage-approach to guide the Township in implementing these recommendations over the next decade.

1. Program Continuation. Significant investment has already been made in the Township’s stormwater infrastructure. This includes the operation and maintenance of 100 miles of storm sewer, 4,451 stormwater inlets, and 572 outfall structures. To maintain the full functionality of these assets and continue to protect public health, safety, and welfare, the Township must continue its infrastructure operations, maintenance, and repair activities (defined in Section 3.3). In 2017, the Township spent approximately $2.25M on this stormwater operations, maintenance, and improvement program.

2. Stormwater System Condition Evaluation. This Plan recommends performing a detailed evaluation of current conditions of the Township’s storm sewer and high priority stream networks. This evaluation will inform the decision-making process for future capital investments and maintenance activities. Through a detailed evaluation of current conditions (i.e. storm sewer televideo, stream monitoring, hydrologic modeling, etc.), the Township can identify:

- The greatest threats to stream water quality and habitat;
- Properties and roads most vulnerable to flood damage;
- Opportunities for flood mitigation;
- The extent of the Township’s Municipal Separate Storm Sewer System (MS4) permit responsibility;
- The structural condition of the MS4; and
- Critical infrastructure improvement projects.

The recommended process to gather this information will take several years to be fully initiated, and longer to complete.

3. Program Investment. With the increased knowledge and understanding of Lower Merion Township’s storm sewer and stream conditions gained in Stage 2, local leaders can communicate needs to the public and propose action in line with community goals. As specific activities and projects are confirmed,
the Township can prepare a Storm Sewer Maintenance Plan and a Stormwater Capital Improvement Plan that document Lower Merion’s funding priorities for water quality and infrastructure management. The Maintenance Plan will include measurable goals for the pace of infrastructure maintenance activities; the Capital Improvement Plan will include traditional grey infrastructure projects and add a new focus on Green Stormwater Infrastructure (GSI). This pivot towards GSI is consistent with the Township’s 2016 Comprehensive Plan’s recommendations for sustainable and resilient infrastructure and the Township’s 2017 Pollutant Reduction Plan (PRP) submitted to the Pennsylvania Department of Environmental Protection (PADEP).

Some of the 22 stormwater projects and activities recommended in these three stages are required by the Township’s MS4 permit; while others are recommended as a strategy to increase the effectiveness of the Township’s program. Therefore, regular review of the Township’s progress towards Plan implementation will be critical to ensure the program best meets local goals. Measured progress will help local leaders understand how well the stormwater program is adapting to changes in water quality regulations, weather patterns, the condition of aging infrastructure, and citizen expectations.

Key aspects of this stormwater program that will result from implementation of these projects and activities recommended to use “innovative methods to efficiently and economically manage municipal stormwater” include:

- **Program administration** with defined responsible parties for specific program tasks;
- **A Storm Sewer Maintenance Plan** that establishes the method and goals for inspection, cleaning, and repair of stormwater conveyance features;
- Projects prioritized in a **Stormwater Capital Improvement Plan**, including opportunities to partner with private property owners, developers, and regional organizations to make progress on flood mitigation and water quality improvements;
- Development of a **Green Stormwater Infrastructure Manual** that defines the Township’s preferred methods and locations for stormwater management; and
- Regular communication with the public to raise **community awareness** of the Township’s stormwater management challenges and strategies.

Funding to implement these recommendations will require the Township to increase its stormwater budget from approximately $2.25M in 2017 to $4.63M in 2027. Approximately 80% of this total program increase ($2.28M) is tied to the capital projects required by changes to the Township’s MS4 permit ($1.81M projected for 2027). Therefore, the Township should invest in an evaluation of its infrastructure and stream networks to make sure this increased investment is directed towards projects and activities that achieve water quality compliance while also meeting Township objectives for urban greening, park improvements, and infrastructure management.

**Section 7** describes the Township’s options for funding Plan implementation and recommended changes to the stormwater program.
2.0 STORMWATER PLANNING

2.1 Water Services Overview
In order to thrive, communities rely on three kinds of water service: delivery of drinking water, treatment of sanitary sewage, and conveyance of stormwater. The three infrastructure systems are generally managed independently. However, there are significant similarities between the management activities required to keep each system functioning as intended. Pipes need to be serviced, water quality standards need to be achieved, and long-term plans need to inform efficient strategies for future capital investments.

Multiple factors impact the delivery of these water-related services to the community. These include the age of development and infrastructure in the community, shared services between neighboring jurisdictions, extreme weather events, topography, and the community’s investment in infrastructure maintenance. This section briefly defines how drinking water and sanitary sewer services are delivered to Lower Merion property owners, followed by a description of management of stormwater runoff and surface water flows across the Township.

2.1.1 Drinking water
Potable drinking water is provided to Township property owners by Aqua Pennsylvania, Inc. Aqua’s source of drinking water in southeast Pennsylvania is eight surface waters located in Montgomery, Delaware, Bucks, and Chester Counties. They treat the source water to remove sediment, pathogens, and other elements and manage the distribution system in accordance with USEPA standards. Aqua prepares a Water Quality Report annually that describes their water quality testing methods, the range of pollutant detection, and any water quality violations. No violations in treatment to meet water quality standards were identified in Aqua’s 2016 Annual Report.

2.1.2 Sanitary Sewer
The Sanitary Sewer Division of the Township Public Works Department operates the sanitary sewer conveyance system. This includes the operation and maintenance of 285 miles of sewer pipes and 17 pump stations. This system serves approximately 75% of the Township land area and 93% of Township residents. Some of the Township’s activities related to the sanitary sewer system include removal of connections from sump pumps, video inspection of sewer pipes, system repair and replacement, and management of pump stations. Discharge from Lower Merion’s sanitary sewers flows into the Philadelphia Water Department’s sanitary sewer conveyance and treatment system. Those portions of the Township without sanitary sewer service rely on on-lot septic systems for treatment, for which the Township requires maintenance.

2.1.3 Stormwater
As development occurs, land use decisions change the way rain water flows across the ground. Instead of infiltration of rain and snowmelt to groundwater, the construction of hard surfaces (or impervious area) such as sidewalks, roads, and buildings increases the amount of water that runs off. Pipes and swales concentrate flows and accelerate the velocity of runoff as it moves downstream, potentially causing erosion of stream channels and disruption to riparian habitats. In addition to changing the volume and rate of runoff, residential, commercial, and industrial land uses each have the potential to contaminate stormwater with debris, sediment and chemicals found on site. The result is stormwater carrying pollutants into local streams. As local municipalities oversee land use decisions, they have a role in managing the flowpath, volume, quality, and rate of stormwater discharge from their stormwater system into local waterbodies.

However, responsibility to manage the Municipal Separate Storm Sewer System (MS4) in Lower Merion is not as straightforward as the management of the potable water and sanitary sewage systems. Sanitary and potable water utilities are closed systems with specific points of access of water to and from the user. All property owners have an impact on the management and transport of rain water to local water bodies. Rain water flows across private property, on institutional campuses, and over industrial facilities before it reaches the Township’s MS4. However, although the Township does not manage all of the land area discharging through its storm sewer outfalls, the quality as well as the volume and velocity of the discharge from publicly owned and operated outfalls to local water bodies remains the Township’s responsibility. Therefore, a multi-disciplinary approach across multiple Township offices is required to educate, engage, regulate, and incentivize all members of the Lower Merion community to properly manage stormwater.
The Township has the ability to coordinate and influence private property owners to manage stormwater. When a private property owner proposes a land development project, the Township gains commitments from private landowners on how they will control runoff and maintain their own stormwater management infrastructure. On property developed prior to current land use regulations adopted by the Township in 2005 (Ordinance 3752, 9/21/2005), however, the Township has limited powers to require retrofits or improvements to achieve a preferred stormwater management standard. In these cases, the Township must 1) rely on private property owners to actively perform operations and maintenance of their infrastructure to protect their investment; or 2) control flows and treat water quality discharging from private property after it has entered the Township’s MS4.

In addition to private property, roads owned by PennDOT and Montgomery County are located within Lower Merion. Those PennDOT and Montgomery County road networks either transport runoff to surface water, or to the Township’s MS4 for discharge through Lower Merion’s outfalls. Within these non-Township rights of way, these entities are responsible for maintaining the stormwater drainage system.

Stormwater also flows through 44 miles of stream channels and seven miles of Schuylkill River frontage. The Township relies on the function of this natural system to transport runoff. The Pennsylvania Department of Environmental Protection (PADEP) has broad authority to ensure the health and function of these surface waters, while the responsibility to make practical day to day decisions about the local streams falls to Lower Merion and private landowners that own the adjacent property.

Table 1 presents the multiple municipal departments and external partners that play a role in Lower Merion’s stormwater management program. Section 3 of this Plan defines the full set of stormwater management activities the Township currently provides, ranging from replacement of storm sewer pipe to public education on spill prevention.

2.1.4 Streams in Lower Merion
All of the runoff from the Township’s 24 square miles of land area eventually discharges into the Delaware Bay through 44 miles of streams (Figure 1). Over 80% (20 square miles) of the Township flows to the Schuylkill River through a set of tributary streams that generally flow west to east to the River. Mill Creek watershed is the largest of these drainage areas to the Schuylkill, with a land area of over eight square miles in the central portion of the Township. Land use in the Mill Creek watershed is generally low to medium density residential, surrounding some areas of parkland and private open space. Institutional properties such as the Shipley School and Bryn Mawr College are located in the headwaters of the Mill Creek. The Gulph Creek, Arrowmink Creek, and Sawmill Run drain the primarily residential northern portions of the Township to the Schuylkill. Gulley Run and Glannraffan Creek receive runoff from the southern portion of the Township runoff, in areas north of City Avenue where higher density residential, commercial, and mixed-use development is predominant.

The remaining 20% of the Township that lies to the south and west of Lancaster Avenue flows south into tributaries of the Darby Creek and Cobbs Creek. These two streams join then discharge through the John Heinz National Wildlife Refuge at Tinicum and into the Delaware River west of the Philadelphia International Airport. Land use in this drainage area is high density residential, commercial, mixed-use, and institutional (e.g., Lankenau Hospital and St. Joseph’s University).
### Table 1. Stormwater Management Activities and Roles

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<th>Township Office/Outside Agency</th>
<th>Function</th>
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| **Board of Commissioners**    | • Allocates staff and budget towards MS4 operations, maintenance, repair, and permit compliance activities  
• Provides opportunities for public comment on stormwater priorities |
| **Manager’s Office**          | • Oversees stormwater program administration |
| **Public Works Department**   | • Inspects outfalls for illicit discharges  
• Performs good-housekeeping and pollution prevention at municipal facilities  
• Operates and maintains MS4  
• Oversees street sweeping and performs leaf collection  
• Performs minor MS4 repairs  
• Maintains map of MS4  
• Responds to citizen inquiries on stormwater issues |
| **Building & Planning Department** | • Tracks illicit discharge detection results  
• Reviews erosion control plans for sites applying for Runoff and Erosion Control Permit or Grading Permit  
• Tracks inspections of private stormwater controls  
• Administers public stormwater education and engagement activities |
| **Township contract engineer** | • Reviews erosion control plans and inspects sites for implementation during construction  
• Reviews land development plans and post-construction stormwater controls  
• Inspects land development sites for installation of stormwater controls  
• Prepares and submits progress reports on MS4 compliance to PADEP |
| **Fire Department**            | • Responds to illicit discharges |
| **Environmental Advisory Council** | • Prepares public service announcements and cable television programs  
• Hosts MS4 public workshops  
• Performs public stormwater education and engagement activities |
| **Montgomery County Conservation District** | • Reviews erosion control plans for sites applying for NPDES permits  
• Reviews proposed post-construction stormwater management controls for sites applying for NPDES permits  
• Inspect earth disturbance sites operating under an NPDES permit |
| **PennDOT and Montgomery County** | • Maintains stormwater infrastructure within their right of ways that serves their roads |
| **Lower Merion Conservancy**   | • Inspects outfalls for illicit discharges  
• Partners with the Township to provide stormwater education opportunities |
| **Narberth Borough**           | • Partners with the Township to provide stormwater education opportunities |
According to the 2010 U.S. Census, the Township has a population of 57,825 residents. Forecasts from the Delaware Valley Regional Planning Commission project that populations will rebound to 1980 levels in 2040 to nearly 60,000. Land use intensity is highest along the Lancaster Avenue corridor as presented by the US Geological Services National Land Cover Database from 2011 (Figure 2). Lancaster Avenue generally serves as the watershed divide between the Schuylkill River and Darby-Cobbs drainage areas. It is at this watershed divide, as well as the City Avenue corridor in the southwest portion of the Township, that impervious area concentration is highest, contributing to high volumes of stormwater runoff and the need for management of runoff.
2.2 Stormwater Plan Data Collection Method

Through a series of interviews, site inspections, a comprehensive stormwater program questionnaire, and a review of existing source documents (i.e. GIS files, capital improvement plans, budgets, MS4 annual reports, pollutant reduction plan, the Comprehensive Plan, and existing codes), a snapshot of the Township’s current stormwater program was developed. The results of this data collection and analysis were captured in a series of preliminary reports used to inform the Comprehensive Stormwater Management Plan. Appendix A lists these documents and includes select reports.

Services provided to Township property owners are categorized throughout this Plan in three Cost Centers:

1. Planning and Administration;
2. Operations and Maintenance; and
3. Capital Investment.

Cost Centers are used to:

► organize data collection,
► to assist in thinking through the elements of the current stormwater program, and
► to organize fundamental services of the future program.

Stormwater management activities, available funding sources, fund utilization, and organizational responsibilities in implementation of stormwater services are fully represented within these Cost Centers. Use
of Cost Centers is helpful in communicating the existing program to the community, stakeholders, and decision makers, as well as for developing documentation on potential changes to the program.

A summary of the current Township’s stormwater program was presented to the public at two meetings in October and November 2017, along with a description of the Township’s stormwater challenges and opportunities. Public input provided is captured in Appendix B, Public Presentations and Notes.

2.3 Trends toward Green Stormwater Infrastructure

Traditional stormwater infrastructure was designed and installed decades ago to convey stormwater away from property and the transportation network. Stormwater infrastructure includes pipes, inlets, and outfalls that serve to capture stormwater runoff from developed areas and transport it to a surface water outfall. The majority of the stormwater infrastructure serving Lower Merion can be categorized as a network of pipes and concrete inlets often referred to as grey infrastructure.

As the frequency of flooding from un-managed stormwater runoff increased, the practice of conveyance of stormwater as quickly as possible to the nearest stream using grey infrastructure changed. Stormwater management measures to detain runoff became an element of land development planning in the 1970’s and 1980’s. It was during this time that regulations were adopted to require developers to manage the flow rate of stormwater leaving a property. Under these regulations, stormwater management structures were implemented to detain runoff from developed drainage areas and release it from the developed sites at flow rates that were more consistent with pre-development runoff rates. These stormwater management structures most often took the form of surface detention basins or underground detention vaults below parking lots. Although these detention structures addressed some flooding concerns by controlling peak flow rates of the discharge, flow velocity and increased flow volume was not managed. Instead, these large volumes of runoff created abnormally long periods of high stormwater flows in streams, causing channel erosion, damage to streambeds and streambanks, and threats property and infrastructure.

To address this extended duration of high stream flows, land use regulations changed again. New standards required developers to manage/remove the increase in runoff volume generated from changes in land cover from a new development. To achieve this reduction in discharge, stormwater infiltration became a preferred method used in land development plan applications. Whereas detention structure design focuses on managing the rate of discharge (i.e. gallons per minute), infiltration structures have greater ability to reduce volume of discharge (i.e. gallons) by letting it soak into the ground. Developers began to install vegetated swales instead of pipes and extended detention basins with permeable soils that allowed for water to recharge the groundwater. When infiltration and groundwater recharge occurs, runoff flowing from a site to the local stream via groundwater takes weeks or months to discharge to a local stream; whereas it takes just minutes or hours to discharge if released from a traditional detention basin outfall pipe. Recharge standards protect riparian habitat by reducing stream flow variability; reducing periods of high stream flow and increasing the amount of flow from the groundwater to streams during dry periods.

Following the introduction of standards for managing the flow rate and volume of stormwater runoff, Federal regulations were issued in 1990 to further protect water quality. Three decades later, these regulations complement impervious area caps in the Zoning code by promoting the use of Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) to treat discharges before release into local water bodies.

- LID is the result of a deliberate design process with the goal of minimizing earth disturbance, removal of vegetation, and connected impervious surfaces. By minimizing the changes to hydrology caused by development, there is less disruption to flows to local streams and wetlands and a decreased need for stormwater conveyance and treatment infrastructure. Design of a LID project promotes thoughtful consideration of a site’s soils, topography, zoning, streams, and vegetation.

- GSI mimics natural conditions by use of vegetation, topography, and soils on a site to actively treat stormwater generated from changes in land cover to improve water quality and for some GSI practices reduce the volume of runoff.
GSI is intended to manage and treat stormwater at its source, while traditional grey stormwater infrastructure is designed to concentrate and then move stormwater away from the built environment. These higher discharge velocities can result in erosion and flooding in urban streams. Traditional grey infrastructure may also concentrate pollutants present on a developed landscape to a single discharge point. GSI uses vegetation, soils, and other elements and practices to restore/mimic the natural processes used to manage stormwater and create healthier urban environments. In addition to stormwater treatment, there is a trend toward GSI for its ability to provide a community with environmental, social, and economic benefits. Adding GSI to supplement grey infrastructure can promote urban livability. For these reasons, the Water Element of the Township’s Comprehensive Plan “recognizes the need to complement grey infrastructure designed to collect and remove stormwater with green infrastructure addressing stormwater where it falls.”

Popular GSI elements, including rain gardens, bio-swales, and green roofs are presented in Figure 3.

► **Rain Gardens.** Rain gardens, also known as bio-infiltration areas, can be installed in almost any unpaved space and are engineered for appropriate soils, entry points, and selection of vegetative matter. They are shallow, vegetated basins that collect and absorb runoff from small areas of impervious surface such as rooftops, sidewalks, and streets. This practice mimics natural hydrology by infiltrating and evapotranspiring (combined effort of evaporation and transpiration to remove water from soil and vegetation) stormwater runoff. Rain gardens can effectively support groundwater recharge, pollutant removal, and runoff detention/reduction of flow volumes.

► **Bio-swales.** Bioswales, or vegetated swales, are essentially rain gardens placed in long narrow spaces, such as between the sidewalk and curb. Vegetated swales slow, infiltrate, and filter stormwater flows. Bioswales can effectively reduce peak stormwater flows, reduce pollutant loads, and enhance biodiversity.

► **Green Roofs.** Green roof systems use engineered soils to support the growth of vegetation atop of buildings. Green roofs help manage stormwater by reducing flow volume through plant uptake. They store rainwater and support evapotranspiration by plants that send it into the atmosphere as water vapor. Green roofs are especially useful in dense urban areas where high intensity land use does not accommodate land area for surface stormwater controls. Green roofs can effectively reduce runoff volumes, regulate building temperatures, reduce urban heat island effect, and provide urban wildlife habitat.

*Figure 3. Green infrastructure examples (L to R: rain garden, bioswale, green roof)*

Implementation of LID and GSI techniques benefits water quality and quantity, air quality, climate resiliency, habitat and wildlife, and communities. Although GSI elements offer multiple community benefits, they may require more resources to construct and maintain over time. Communities and property owners deciding
between the traditional stormwater management techniques and a GSI approach must consider the cost and required long-term investment in managing their stormwater and compare with the additional benefits GSI can offer.

2.4 Trends in Municipal Street Sweeping
In 2017, Lower Merion contracted street sweeping services to sweep all Township streets three times over the course of the year. Mechanical brush sweeping removes leaves and litter from the curb line to improve aesthetics and prevent this debris from clogging stormwater inlets and pipes. The Township has also invested in a regenerative air street sweeper to pick up smaller-sized material, including the fine sediment that PADEP has designated as a pollutant of concern to local streams.

The Township anticipates continuing three street-sweeping passes in 2018 with the mechanical sweeper and select use of the regenerative air sweeper. The Township is evaluating the best use of the regenerative air sweeper. Early experience shows that the regenerative air sweeper is best used when it follows immediately after the mechanical brush sweeper. The regenerative air sweeper also has application supporting the Township’s street paving activities.

PADEP includes street sweeping as a sediment reduction method and offers MS4 permittees the option to claim credit towards their sediment reduction goal. Specifically, PADEP states that for each street mile swept 25 times annually with a regenerative air sweeper, the permittee may claim a 9% sediment reduction from an acre of impervious area. Lower Merion has decided not to include street sweeping as a sediment reduction tool to support their MS4 responsibilities. The benefit of increasing from three sweeping of each street annually to 25 is minimal when compared against other sediment reduction strategies (i.e. stream restoration, bioretention). Street sweeping using the mechanical brush sweeper will continue to serve to maintain removal of debris along the curb line, and reduce clogging of storm inlet grates and storm sewer pipes.
3.0 CURRENT STORMWATER MANAGEMENT PROGRAM

Managing stormwater is one of the fundamental responsibilities of local municipalities. As infrastructure ages, precipitation patterns change, and water quality regulations increase, the complexity of managing stormwater grows. However, the goals for the Township’s stormwater management program and responsibilities remain consistent, focusing on protecting public safety, private property, and the environment. This section describes the Township’s five drivers for managing stormwater, the limits of Township authority, the Township’s current stormwater activities, and the cost of the current stormwater program.

3.1 Township Stormwater Drivers

Five drivers influence Lower Merion’s decisions on how to manage stormwater to protect the public, property, and environment. To varying degrees, these drivers include compliance with federal regulations, meeting the public’s expectations for environmental sustainability, and addressing the Township’s principle of delivering efficient services to the public. These drivers answer the question:

► Why does Lower Merion manage stormwater?

3.1.1 Water Quality Compliance

The Township is classified by the PADEP as an owner/operator of a Municipal Separate Storm Sewer System (MS4). This designation is a result of the Township’s location within an Urbanized Area as defined by the U.S. Census Bureau. Lower Merion is required to obtain PADEP authorization to discharge stormwater under PADEP’s administration (representing USEPA) of the National Pollutant Discharge Elimination System (NPDES) Permit program established by the Clean Water Act, as amended. To comply with the MS4 Permit, the Township is responsible to implement and maintain six Minimum Control Measures (MCM) aimed at preventing/reducing the discharge of pollutants from MS4 outfalls to local streams:

1. Public Education and Outreach on Stormwater Impacts
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination (IDD&E)
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management (PCSM)
6. Pollution Prevention/Good Housekeeping

The Township has maintained compliance with their MS4 permit since 2003 through implementation of best practices for each of the six MCM’s, keeping the Township’s land development regulations consistent with PADEP’s standards, and filing regular reports to PADEP. Starting in 2018 with the renewal of the MS4 Permit, the Township will be required to take two additional actions to achieve compliance. The transition to the 2018 permit will change the Township’s program from one primarily focused on stormwater education and inspection, to a program where the Township is required to construct water quality controls that reduce the impact of urban stormwater runoff on local streams.

► PCB pollutant control measures. The requirement to inventory and perform preliminary investigation of potential sources of polychlorinated biphenyls (PCB) is associated with the Schuylkill River’s status as impaired by this pollutant.

► Sediment discharge reduction. Because Lower Merion discharges stormwater to streams considered by PADEP as impaired by excessive sediment generated from urban stormwater runoff, the MS4 permit requires the Township commit to implementing practices to reduce sediment discharged from the MS4 into local streams. Specifically, PADEP’s MS4 Requirements Table (Municipal) (revised 03/05/2018), states that the Township is required to develop a Pollutant Reduction Plan (PRP) for 13 streams that are impaired by Siltation or Total Suspended Solids (TSS). The Township has developed a PRP that commits to stabilizing approximately two miles of streambank and retrofitting two stormwater detention basins during the next MS4 permit period (five
years, 2018-2023). Discussion of the PRP and the Township’s water quality responsibilities are detailed in the *TMDL Responsibility Report* included in Appendix A.

3.1.2 **Flood Mitigation**
In summer 2004, the Township experienced a series of intense rain events that caused flooding on private property, the transportation network, and public facilities across the Township. These storms resulted in the development of the *Township-Wide Stormwater Management Program* with objectives to investigate flooding concerns, identify the cause of flooding, identify solutions, and recommend priority projects based on current policy. Annually since 2006, the Township has allocated Township funds to design and construct capital stormwater projects prioritized in the *Township-Wide Stormwater Management Program* to protect the public, property, and the environment from floodwaters.

3.1.3 **Infrastructure Management**
The Township relies on 100 miles of storm sewer pipes, 4,451 stormwater inlets, and 572 outfalls to drain runoff away from streets and property to local streams (Figure 4). To maintain the proper function of this infrastructure and extend its lifespan, the Township maintains and repairs this system by flushing storm sewer pipes, cleaning and repairing stormwater inlets, performing post-storm clean-up of debris, and sweeping streets. These activities represent a significant investment in an important infrastructure network.

3.1.4 **Public Responsiveness**
The Township administers grading and land development permits that require applicants to design and construct improvements, including stormwater controls. The Township reviews plans submitted by property owners and inspects development projects. The goal of this review is to make sure improvements are constructed consistent with the Township’s objectives for protecting public safety, private property, infrastructure, and the environment. In addition, residents and business owners periodically request Township personnel assistance to evaluate damage caused by stormwater on private property. Investigation could address impacts from runoff from private property, from runoff from the public right of way, flooded basements, or a report of a spill. Township inspectors review individual requests for assistance, determine the Township’s extent of responsibility, include other parties as appropriate, and take action when necessary.

3.1.5 **Program Administration**
Stormwater management services provided by the Township include tasks that regularly overlap with other municipal services. For instance, the same equipment used to inspect the sanitary sewer system can be used to inspect the storm sewer system. Township staff manage the use of equipment, contracts, materials, and personnel time across the multiple services and projects provided by the Township so that public resources are most effectively used.
Figure 4. Stormwater Conveyance Features

<table>
<thead>
<tr>
<th>Stormwater Conveyance Feature</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Sewer Manholes</td>
<td>705</td>
</tr>
<tr>
<td>Storm Sewer Inlets</td>
<td>4,451</td>
</tr>
<tr>
<td>Storm Sewer Pipes</td>
<td>102 miles</td>
</tr>
<tr>
<td>Storm Sewer Outfalls</td>
<td>572</td>
</tr>
<tr>
<td>Stream Length</td>
<td>44 miles</td>
</tr>
<tr>
<td>Schuylkill River</td>
<td>7 miles</td>
</tr>
</tbody>
</table>
3.2 Limits of Township Governance
Lower Merion Township has jurisdiction over land use decisions, and therefore has authority to direct stormwater management practices during the design of land developments and site improvements proposed in the Township. However, regulations such as the Pennsylvania Municipalities Planning Code provide the Township with only limited ability to influence stormwater management decisions on private land when not engaged in the land development process. This section discusses the extent of the Township’s ability to:

- Direct the construction of stormwater management structures;
- Influence selection of preferred stormwater management methods; and
- Partner with private property owners for access to the best sites for managing stormwater.

3.2.1 Proposed Land Development and Site Improvements
In 2016, the Township completed its Comprehensive Plan to guide land use policy. This document guides the Township’s stormwater management policies, set forth in the Stormwater code, Land Development code, and Zoning code. Through the land development process, developers must meet the Township’s minimum standard for managing the rate, volume, and quality of stormwater runoff. The Township requires owners of properties with stormwater controls to regularly certify the function of each control. For development projects disturbing greater than one acre of earth, the Township requires property owners to record the maintenance plan for the stormwater controls on the property deed (consistent with Title 25, Chapter 102 of the Pennsylvania Code). In addition to the minimum development standard defined in the Township code (further discussed in Section 5.3.2.8), the Township could attempt to further improve stormwater management using the following available tools:

- Request developers consider installing stormwater controls above the minimum standard as part of their site improvement process.
- Offer incentives in the Township code to manage stormwater above the minimum standard by offering applicants greater flexibility on certain development elements (i.e. building height, street trees).
- Establish an option for payment of a fee in-lieu-of construction of stormwater management infrastructure with specific criteria and terms to be met by developers. Funds generated through this option would be used to support the Township’s effort to construct stormwater management controls within the same drainage area as the development.
- Propose a partnership with a developer on a joint stormwater project on a development site with the intent to improve stormwater management on one or multiple parcels.

3.2.2 Existing Land Use
The Township has limited authority to require improvements to stormwater management infrastructure on private property not actively engaged in the land development process. There are two exceptions to this limit on the Township’s authority. The first allows the Township to take action when there is a potential threat to public health, safety, or welfare. The second condition is when the Township has secured a maintenance agreement with the owner during the land development approval process. In Lower Merion, these agreements are required when new impervious area greater than 1,500 square feet is proposed. Agreements define:

1. the maintenance operations to be performed on a stormwater management structure;
2. the responsible party; and
3. the Township’s rights to access the site to inspect the facility.

In light of these limitations, the Township can establish policies that offer property owners incentives to promote implementation of new or expanded stormwater controls on private property. These incentives could include offers to:
Subsidize purchase of a rain barrel or installation of a rain garden on a residential property. This action generally supports public engagement in stormwater issues. Whereas one owner who installs a rain barrel does not provide measurable stormwater rate, volume, or quality control; a neighborhood that organizes all property owner’s involvement, can have a measurable impact.

Offer a grant program to encourage property owners to install new or enhanced stormwater controls on site, such as a stormwater basin retrofit or rain garden.

Partner on stormwater control projects with owners of properties that have topography, soils, and drainage characteristics able to manage stormwater from large areas of impervious area (either on-site or from multiple parcels).

Provide credits for managing stormwater that can be applied toward reduction of a property owner’s annual user fee, if such a user fee were established.

3.3 Current Stormwater Services
This section provides a brief description of the Township’s various stormwater management services, categorized by the three functional cost centers listed in Section 2.2.

3.3.1 Cost Center: Planning and Administration

Public education and engagement. The Township implements an outreach and education program following the guidelines of the first two Minimum Control Measures (MCM) defined in PADEP’s MS4 permit. Topics include proper use of lawn care chemicals, description of how impervious area impacts stream networks, and specific activities residents can perform to prevent discharge of pollutants. The Township’s Environmental Advisory Council (EAC) uses newsletters, websites, meetings, workshops, and public service announcements to reach the general public and business community. The Lower Merion Conservancy is active in the Township providing water quality and pollution prevention education activities. These are often promoted to the community by the Township.

MS4 program compliance. The Township Building and Planning and Public Works Departments implement the MS4 permit compliance program, including preparation of the annual report for submittal to PADEP. The Township contracts for technical support in management and implementation of various best practices required. The focus of the MS4 permit is the six MCMs defined in Section 3.1.1.

In 2017, the Township developed a Pollutant Reduction Plan (PRP) to reduce the discharge of sediment to local impaired streams by 10%, as required by the MS4 permit. The PRP defined approximately two miles of stream restoration projects and two stormwater basin retrofits to achieve this mandated sediment reduction by 2023. Lower Merion committed to investigate suspected sources of PCB and prepare a report to submit to PADEP, as required.

Land development ordinances. The Township Building and Planning Department administers the review of land development plans and site improvement permit applications. These include the review of required stormwater management and landscaping plans. Township oversight includes a review of the compliance of a developer’s proposal with all applicable requirements within the Township’s current code, including the Subdivision and Land Development code (SALDO, Chapter 135), the Stormwater Management and Erosion Control code (Stormwater code, Chapter 121), and the Natural Features Conservation code (Chapter 101). The Township’s SALDO includes minimum standards for how improvements are constructed and defines the process of designing and laying out a land development plan. The Township last updated the Stormwater code in 2012, requiring post-construction stormwater management for activities that add 1,500 square feet of impervious cover (121-2.C.2).

Public responsiveness. The Building and Planning Department provides timely review and administration of land development and site improvement permit applications submitted by property owners. Following approval of land development applications, Township personnel meet with
developers and contractors on site to inspect construction sites for proper implementation of erosion controls and the stormwater management infrastructure installed to manage runoff following the completion of improvements. In addition, the Public Works Department responds to complaints and comments from the public related to stormwater and conveyance infrastructure. Public Works personnel investigate stormwater issues identified by property owners and responds with recommendations and assistance from the Township, if appropriate.

3.3.2 Cost Center: Operations and Maintenance

► Operate and maintain existing stormwater infrastructure. Public Works is responsible for maintaining the Township-owned stormwater conveyance system. General maintenance activities include inlet cleaning and removal of debris and storm sewer pipe clean out. The Township targets a three-year cycle for cleaning and inspecting all storm sewer inlets. Maintenance is performed following complaints from property owners or identification of system maintenance issues by Township personnel. Public Works place barricades in strategic locations prior to large storm events in case roadways are flooded and impassable. Public Works assists in the set-up and removal of these barricades when necessary and in the clean-up of debris left by floodwaters. Figure 4 presents the extent of the Township’s stormwater inlets, pipes, outfalls, and manholes that make up the conveyance network.

► Minor storm sewer repair. Public Works crews repair and replace inlets, catch basins, and small sections of deteriorated storm sewer pipe on an as-needed basis.

► Street sweeping. Lower Merion outsources street sweeping services. The 2017 contract included three sweeping cycles for all streets in the Township using a mechanical brush sweeper. The Township has recently purchased a regenerative air sweeper that is effective at collecting fine materials. Public Works personnel will integrate this new sweeper into the current street sweeping program as appropriate to keep debris and sediment from entering the storm sewer and into local water bodies. The Public Works Director is responsible for street sweeping service procurement.

► Storm sewer mapping. The Township updates spatial data in its geographic information system (GIS) to maintain an accurate map of the storm sewer network as new system components are identified, as repairs are made, and as new development occurs that adds new features.

► Illicit discharge detection & elimination. The Township Public Works Department coordinates preliminary dry weather screenings of MS4 outfalls with the Lower Merion Conservancy (LMC) to identify illicit connections to the storm sewer. The Township provides LMC personnel with safety and monitoring training and assigns a set of outfalls for screening that are easily accessed from the public right of way. Outfalls that are not easily accessed remain the responsibility of Township staff to screen. The Township maintains PADEP’s emergency contact and an Illicit Discharge Reporting Form for reporting suspected illicit discharges on the Township website. Reports of illicit discharges are generally addressed by the Fire Department or the Public Works Department.

► Maintenance tracking of private stormwater controls. In addition to existing stormwater controls on private property, the Township requires post construction stormwater management controls and associated Maintenance Agreements for all regulated construction activities and site improvements. The Township tracks maintenance of these controls through a biennial inspection process to monitor their function managing the rate, volume, and quality of runoff as designed.

► Good house-keeping at municipal facilities. Township personnel prevent the discharge of pollutants via stormwater from municipal facilities by sweeping parking areas, performing visual inspections of potential pollutant sources, maintaining vehicles and equipment, storing materials indoors, and training staff on proper stormwater management.

► Shade Tree Program. Shade trees provide a stormwater benefit by intercepting rainfall to slow the flow of runoff, and cooling impervious area to moderate the temperature of runoff. Shade trees have also been shown to benefit the community by calming traffic, improving property values, and reducing
the urban heat island effect. The Township’s Shade Tree Program manages trees on Township facilities and within the public right of way. Services provided include tree maintenance and leaf collection to prevent blockages of the storm sewer system.

**Routine equipment maintenance.** The Fleet and Equipment Maintenance Division within Public Works maintains Township vehicles, including those used in stormwater related activities. **Table 2** presents some of the storm sewer operations activities and associated vehicles and equipment. These vehicles and equipment are critical to the stormwater program and utilized for a number of operational objectives. They are not dedicated to stormwater operations. Each supports multiple purposes across the Township, including street repair, park maintenance, and sanitary sewer investigation.

**Table 2. Vehicles/Equipment Available for Use for Stormwater Management**

<table>
<thead>
<tr>
<th>Storm Sewer Operations and Maintenance Activity</th>
<th>Vehicle/Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Cleaning</td>
<td>Vacuum trailer</td>
</tr>
<tr>
<td></td>
<td>Dump truck</td>
</tr>
<tr>
<td></td>
<td>Pick-up truck</td>
</tr>
<tr>
<td>Inlet Repair</td>
<td>Dump truck</td>
</tr>
<tr>
<td></td>
<td>Pick-up truck</td>
</tr>
<tr>
<td></td>
<td>Knuckle broom</td>
</tr>
<tr>
<td>Leaf Collection</td>
<td>Dump truck</td>
</tr>
<tr>
<td></td>
<td>Pick-up truck</td>
</tr>
<tr>
<td>Street Sweeping</td>
<td>Street sweeper</td>
</tr>
<tr>
<td>Stormwater Complaints</td>
<td>Pick-up truck</td>
</tr>
<tr>
<td>Illicit Discharge Detection &amp; Elimination</td>
<td>Pick-up truck</td>
</tr>
</tbody>
</table>

3.3.3 Cost Center: Capital Investment
Since 2006, the Township expended over $8M (approximately $740K annually) on capital improvements to the stormwater drainage network to address the objectives stated in the **Township-Wide Stormwater Management Program**. The Township relies on traditional grey infrastructure to achieve these objectives. These projects include the installation of larger pipes, new curbs and gutters, berms, culverts, and storm sewer inlets. Lower Merion periodically updates the list of projects in the Program, prioritizes projects, and evaluates progress of flood mitigation activities and updates priorities to maintain consistency with Township policies and protect the public, property, and the environment.

In 2014, the Township partnered with the Lower Merion Conservancy to receive a grant for $140K from the National Fish and Wildlife Foundation to stabilize the banks of the Indian Creek in Shortridge Park. The Township matched this grant with approximately $190K.

3.4 Estimated Cost of Current Services
**Figure 5** presents the estimated annual cost associated to perform all of the activities and projects in each of the stormwater program Cost Centers. These costs were obtained through interviews with Township personnel and research of documents, budgets, and cost accounting tables from 2017. Documentation of current stormwater program costs and assumptions are included in **Appendix A, Stormwater Program Projection**. In addition to grey infrastructure capital improvements (approx. $740K), the largest line items include operation and maintenance of the storm sewer network ($770K) and minor storm sewer repair ($430K) in the Operations and Maintenance Cost Center.
Figure 5. Current Stormwater Program Annual Costs Organized by Cost Center

<table>
<thead>
<tr>
<th>Functional Cost Center</th>
<th>Approx. Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and Administration</td>
<td>$0.11M</td>
</tr>
<tr>
<td>Operations and Maintenance</td>
<td>$1.40M</td>
</tr>
<tr>
<td>Capital Investment</td>
<td>$0.74M</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$2.25M</strong></td>
</tr>
</tbody>
</table>

**Note:** The *Stormwater Program Projection found in Appendix A* includes the basis for the current program costs presented here. Figure 3 of that document lists the following items that make up the Township’s 2017 stormwater program:

<table>
<thead>
<tr>
<th>Service/Project</th>
<th>Approx. Annual Cost</th>
<th>Functional Cost Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Operate and maintain existing storm sewer</td>
<td>$770K</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>1b. Install gray infrastructure capital improvements</td>
<td>$740K</td>
<td>Capital Investment</td>
</tr>
<tr>
<td>1c. Perform minor storm sewer repair</td>
<td>$430K</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>1d. Comply with MS4 permit – 6 MCMs</td>
<td>$110K</td>
<td>Planning and Administration</td>
</tr>
<tr>
<td>1h. Street sweeping</td>
<td>$160K</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>1i. Dedicate funding for vehicle and equipment replacement</td>
<td>$40K</td>
<td>Operations and Maintenance</td>
</tr>
</tbody>
</table>
4.0 STORMWATER PROGRAM GAPS

The Township faces several stormwater challenges, including aging infrastructure, local flooding, land development pressures, and water quality regulations. The stormwater services currently performed by the Township focus on these challenges. However, a gap between current activities and future needs is anticipated to grow. Consistent with the recommendations of the Township Comprehensive Plan, a review of the Township’s current stormwater services, and discussions with Township personnel, a cohesive and comprehensive program of stormwater management services is warranted to enable Lower Merion to adapt to these challenges. This section identifies specific new and expanded stormwater services for integration into the existing stormwater program as well as elective stormwater management elements that could support the Township’s stormwater management and community development goals.

Table 3 defines the challenges and issues in the Township’s current stormwater program and potential program elements to address them. The proposed activities and projects are organized by Cost Center (defined in Section 2.2) with notes about how they fill a Township responsibility. It is assumed that all current stormwater activities performed by the Township will continue.

Addressing the Township’s programmatic needs identified in this Section may require an increase in the pace of operations and maintenance activities, additional staff support, or additional knowledge of the condition of the stormwater infrastructure. Some gaps and other implementation efforts may be filled with relatively simple adjustments to existing services. However, certain service areas may continue to expand over the next few years (i.e. PCB source inventory, reduction in sediment loading) and require the Township to take on entirely new stormwater program elements.

Municipal activities and projects to address needs in the Township’s existing stormwater program fall into one of two categories, as identified in Table 3.

1. **Critical stormwater program elements** are needed to address services that will be required in the future to mitigate flooding and to meet the minimum standards of the MS4 permit.

2. **Elective stormwater program elements** are activities and projects that the Township could choose to implement to inform decisions for directing resources for capital stormwater projects and programmatic activities.
<table>
<thead>
<tr>
<th>Cost Center</th>
<th>Stormwater Program Element</th>
<th>Critical Element</th>
<th>Existing Stormwater Program Gaps</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and Administration</td>
<td>Public education and engagement</td>
<td>Lower Merion’s compliance with MCM1 and 2 of the MS4 permit raises awareness about stormwater issues and aims to change behaviors to improve water quality. However, a more robust education program would inform the public of the Township’s stormwater opportunities and challenges, inform the public about the Township’s stormwater management strategies, and seek public input on Township stormwater activities and projects.</td>
<td>✔️ ✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MS4 program compliance</td>
<td>• The Township’s 2018 MS4 permit requires new compliance strategies in addition to the current 6 MCMs. The 2018 MS4 permit requires action to address each impaired stream to which the MS4 discharges through the development and implementation of a Pollutant Reduction Plan. The 2018 MS4 permit requires that the Township develop an inventory of potential sources of PCB and perform preliminary evaluation. ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land development ordinances</td>
<td>• The land development approval process is one of the few opportunities the Township has to influence land use decisions to improve stormwater management. The existing code could be revised to increase opportunities to direct the land development process to meet water quality and discharge rate/volume reduction goals. ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green Stormwater Infrastructure Plan</td>
<td>• The use of GSI to manage stormwater can provide multiple benefits to the community as described in Section 2.3. The Township is shifting to the use of GSI as the preferred method for reducing sediment discharge to local streams as part of MS4 permit compliance. However, not all GSI practices are appropriate in every community. The Township does not provide guidance developers on the Township’s preferences for the use of GSI on public proprieties or in the right of way or on the most effective practices for this region of southeast PA. ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coordinated regional land use planning</td>
<td>• Engagement in a regional approach to stormwater management has the potential to reduce the cost of infrastructure management, permit compliance, or sediment reduction (i.e. street sweeping, public education, illicit discharge inspections, stormwater basin retrofits). Other than a partnership with the Lower Merion Conservancy, the Township is currently not engaged in any regional approach to stormwater management. ✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water quality monitoring program</td>
<td>• The Township is required to comply with the MS4 permit by reducing sediment discharge to local water bodies. However, the extent to which the streams are impaired (degree of impairment, source of impairment, location of impairment) is unknown. Therefore, the Township does not have sufficient information to identify the most effective water quality improvement projects. ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program administration</td>
<td>• As the Township provides additional stormwater services, current staffing levels may need to be expanded or coordinated to gain the capacity to administer additional tasks (i.e. contracts, work orders, procurement, requests for assistance). ✔️ ✔️</td>
<td>✔️ ✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grant pursuit strategy</td>
<td>• Funding for more of the Township’s infrastructure replacement and water quality activities could be provided by grants from state agencies, USEPA, or private foundations. The Township has staff that develop grant applications, but does not have a specific strategy to pursue stormwater infrastructure grants. ✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Cost Center</td>
<td>Stormwater Program Element</td>
<td>Critical Element</td>
<td>Existing Stormwater Program Gaps</td>
<td>Drivers</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Operations and Maintenance</td>
<td>Operate and maintain existing stormwater infrastructure</td>
<td>✓</td>
<td>The Township does not have a formal MS4 operations and maintenance plan that includes an inventory of storm sewer system current conditions and an action plan aimed at extending the functional lifespan of the MS4.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Minor storm sewer repair</td>
<td>✓</td>
<td>The Township’s response to localized reports of failing or clogged pipes is reactive in nature. Without a complete system inventory and condition assessment, the Township is not able to proactively optimize system performance.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Street sweeping</td>
<td></td>
<td>The Township has acquired a regenerative air sweeper to complement its current mechanical brush sweeping program. The Township needs to utilize this equipment in targeted drainage areas to maximize the street sweeping program’s ability to keep sediment and floating materials from entering the MS4 and discharging to local water bodies.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Storm sewer mapping and system televideo</td>
<td>✓</td>
<td>The current map is adequate for locating MS4 features but does not provide complete understanding of the system. There is no clear identification of the Township MS4 stormwater conveyance system as opposed to those stormwater systems that are not the responsibility of Lower Merion. The Township has not performed a comprehensive or systematic evaluation that could inform strategies for operations and maintenance, repair, and system replacement.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Illicit discharge detection and elimination</td>
<td>✓</td>
<td>The Township has not determined which outfalls are regulated by the Township MS4 permit. The Township may be taking responsibility for MS4 outfalls owned and/or operated by others.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Maintenance tracking of private stormwater controls</td>
<td>✓</td>
<td>The Township’s tracking system does not differentiate between private stormwater controls for which the Township is required to confirm functionality as a condition of their MS4 permit and other controls that are not subject to the MS4 permit inspection requirement. Therefore, the Township may be tracking more stormwater controls than necessary, instead of concentrating resources on those that have the greatest impact to water quality and flood mitigation.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Good house-keeping at municipal facilities</td>
<td>✓</td>
<td>To enhance compliance with the good house-keeping standard in the MS4 permit, the Township should regularly review and update the 1) inventory of pollution prevention activities across all Township facilities, 2) written schedules and procedures for managing stormwater and pollutant sources, and 3) stormwater training program for Township staff.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Operate and maintain new water quality controls</td>
<td>✓</td>
<td>Implementation of the Township PRP will result in new stream restoration projects and stormwater basin retrofits. Upon completion, the Township will need to implement an inspection, operations, and maintenance plan for each new stormwater control, as well as any other new GSI elements.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Hydrologic model of priority watershed</td>
<td>✓</td>
<td>The Township has not quantified how water flows through its streams and stormwater system to understand the source and potential solutions of flooding issues in the Township.</td>
<td>✓</td>
</tr>
<tr>
<td>Capital Investment</td>
<td>Stormwater Capital Improvement Plan</td>
<td>✓</td>
<td>The Township does not have a formal process to regularly update the Township-Wide Stormwater Management Program with prioritized stormwater infrastructure projects to incorporate: Sediment reduction projects that are consistent with the PRP; and GSI projects that serve to manage stormwater and provide other community benefits (i.e. urban greening, property values, tree planting in stormwater bump-outs to provide traffic calming benefits). The Township has not specifically designated Township resources to perform the design, construction, and maintenance of the stormwater controls prioritized in the Township-Wide Stormwater Management Program and the PRP.</td>
<td>✓</td>
</tr>
</tbody>
</table>
5.0 STORMWATER PROGRAM RECOMMENDATIONS

5.1 Guiding Strategies
The previous sections of this Plan answer the following questions:

► Why does Lower Merion manage stormwater? What are the drivers?
► What are Lower Merion’s current stormwater services?
► What service challenges and opportunities exist in the Township’s stormwater program? What program gaps exist now and in the near future?

This section begins with a discussion to answer the question:

► What strategies will guide the Township’s future stormwater program to address these drivers, build on current services, and address anticipated challenges and opportunities?

Five guiding strategies are defined below that are generally consistent with existing Township policies and the feedback provided from staff and the public through the stormwater planning process.

5.1.1 Maintain current services
It is assumed that the Township’s stormwater management services (Section 3.3) will generally continue as they are currently being performed. These traditional activities include maintenance and upgrade of the storm sewer infrastructure, attending to the six MCMs of the MS4 permit, and responding to property owners’ stormwater management issues. There are some recommended changes to the delivery or level of effort of existing services, including:

► Reduction in capital investment away from traditional grey infrastructure;
► Shift in capital investment to GSI and sediment reduction projects;
► Evaluation of the optimal mix of street sweeping technology; and
► Revisions to the program to track stormwater controls on private property.

5.1.2 Educate and engage the public
Stormwater management is a multi-disciplinary topic that touches many facets of public interest. Therefore, the Township stormwater program should be supported by an organized campaign to communicate the Township’s stormwater challenges and priorities to the public. This campaign should provide general stormwater information to the public, distribute specific information for targeted stormwater management issues, and provide community members with the opportunity to voice their opinion on Township stormwater management strategies.

5.1.3 Add to the Township’s knowledge base
Municipal stormwater programs need to maintain two perspectives when providing services to residents and property owners: 1) regular day-to-day operations of the stormwater network, and 2) long-term planning for future capital projects and compliance responsibilities. Local leaders that have information about the storm sewer infrastructure, the natural stream network, available equipment, and the availability of Township personnel can make effective decisions about how to direct municipal resources and achieve a proactive and efficient stormwater management program. A greater understanding of resources and existing conditions allow the Township to:

► Implement a proactive infrastructure inspection and maintenance schedule;
► Prioritize capital improvements;
► Make decisions on whether services should be provided by Township staff or contract services; and
► Negotiate water quality compliance terms with regulators.
5.1.4 Direct public funds to public projects
Since 2006, the Township’s implementation of the Township-Wide Stormwater Management Program has focused resources on projects that manage and convey stormwater flows either on public property or within the public right of way. This is consistent with the idea that the investment of public dollars should focus on providing a quantifiable public good. Lower Merion anticipates continuing this philosophy. However, the Township is aware that progress towards addressing some stormwater gaps (i.e. sediment reduction) might be most efficient when select investment of public resources is directed to specific stormwater controls on private property to achieve a measurable public benefit.

5.1.5 Demonstrate priorities through land use policies
The Township can manage stormwater on Township property and within its rights of way, but has limited influence over how stormwater is managed on private property. Land development standards and clear communication of Township stormwater management preferences are critical tools to use to assert this influence when opportunities arise.

5.2 Summary of Recommended Projects/Activities
This section describes stormwater projects and activities, organized by Planning and Administration, Operations, and Capital Projects, that address the Anticipated Stormwater Program Gaps presented in Section 4. Each project or activity is consistent with the five Guiding Strategies to help the Township achieve one of the key drivers (Section 3.1) for managing stormwater. Table 4 summarizes all the proposed recommendations and presents how the project or activity changes the Township’s current level of stormwater service as:

- A new stormwater service recommended to be performed by the Township;
- An existing Township stormwater service recommended for expansion; or
- A continuing Township stormwater service with no changes to current implementation, or only minor adjustments.
<table>
<thead>
<tr>
<th>Cost Center</th>
<th>Recommended Project or Activity</th>
<th>Critical Element</th>
<th>Continued Service</th>
<th>Expanded Service</th>
<th>New Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning and Administration</strong></td>
<td>Administer the stormwater program</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comply with the MS4 permit</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>Extend public education and engagement strategy</td>
<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>Revise select land development regulations</td>
<td></td>
<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>Expand grant writing/management capacity where appropriate</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Develop GSI Plan and Stormwater Design Manual</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Define, implement, and regularly review water quality monitoring program</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Prioritize watersheds for action</td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td></td>
<td>Participate in regional communication on water resource issues</td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td></td>
<td>Define and implement PCB Pollutant Control Measures</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td></td>
<td>Assess perflourinated compound sources</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Fund GSI incentive program</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Operations and Maintenance</strong></td>
<td>Operate and maintain stormwater infrastructure</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform good-housekeeping at municipal facilities</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>Perform minor storm sewer repair</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<td></td>
<td>Sweep streets</td>
<td></td>
<td>✓</td>
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<tr>
<td></td>
<td>Dedicate funding for vehicle/equipment replacement</td>
<td></td>
<td>✓</td>
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<tr>
<td></td>
<td>Perform storm sewer outfall illicit discharge detection and elimination</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td></td>
<td>Perform hydrologic modeling of a priority watershed</td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td></td>
<td>Define and implement inspection protocols for private stormwater controls</td>
<td></td>
<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>Define and implement storm sewer televisio schedule</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Capital Investment</strong></td>
<td>Establish, review, and update Stormwater Capital Improvement Plan, that includes</td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>➤ Pollutant Reduction Plan (PRP) projects</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➤ Grey infrastructure capital improvements</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➤ GSI improvements</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
5.3 Recommended Projects and Activities by Cost Center

5.3.1 Cost Center: Planning and Administration

5.3.1.1 Administer the stormwater program. The Township should identify a staff position (or develop a contract) to direct and track the wide variety of stormwater services the Township provides. This position should be tasked with coordinating the operations, maintenance, compliance, review, and improvement of the Township’s stormwater program. The stormwater program administrator could report to the Township Manager’s office, while interacting with Township personnel across departments to direct program elements. Activities to be coordinated by a stormwater program administrator should include:

- Capital project administration;
- Participation in the Township’s inter-departmental working group;
- Purchase of materials or services for repair of stormwater infrastructure;
- Education strategy implementation;
- Compliance and enforcement of land use codes;
- Property owner response;
- Land development code review;
- Opportunity planning;
- Mapping updates; and
- Maintenance of stormwater controls.

By aggregating stormwater activities under the direction of one office, the Township enhances existing accountability to:

- Track the Township’s resources directed toward stormwater-related projects and activities;
- Prioritize stormwater program activities and projects;
- Define progress towards measurable stormwater management goals; and
- Direct municipal resources to where they are most effective.

5.3.1.2 Comply with the MS4 Permit. MS4 permittees are required to achieve compliance with the following four components of the MS4 permit:

- Comply with the six MCMs defined by PADEP (see Section 3.1.1);
- Track activities to include in annual reports to PADEP;
- Prepare and implement a PRP to reduce the discharge of sediment from the MS4 to streams impaired by stormwater runoff; and
- Perform preliminary investigation of potential sources of PCB to the Schuylkill River.

To achieve compliance, the Township should add detail to their internal written MS4 compliance plan and regularly measure progress towards the minimum standard of each of the four MS4 program components listed above. If progress is not sufficient, the Township should review the assignments to responsible parties, proposed timelines, and available resources; and amend the written MS4 compliance plan accordingly to meet each measurable goal.

5.3.1.3 Extend public education and engagement strategy. The Township already implements a program of public outreach and engagement directed to meet the requirements of the MS4 permit (MCM1 and MCM2). Lower Merion should add detail to their current written public outreach program to comply with the MS4 permit by identifying specific messages, target audiences, regional partnerships, and community activities that address the water quality issues of greatest concern.

In addition, to address the fact that the Township’s stormwater management responsibilities are increasing and that Township authority to manage stormwater on private land has limitations, public education and outreach efforts should grow beyond the minimum MS4 permit standards. This engagement program should be expanded to support the Township’s entire stormwater program.
Education and outreach should be targeted to increase public awareness of the challenges the Township faces in delivery of stormwater services (i.e. flooding, water quality and infrastructure management), and to inform public input offered to elected officials on stormwater program decisions. Specifically, an education and outreach campaign focused on specific messages to target audiences can emphasize 1) the Township’s stormwater management strategy; 2) the Township’s priorities for allocating public resources towards stormwater improvements; and 3) the use of appropriate stormwater management techniques on private properties. Continuing partnerships with groups such as the Lower Merion Conservancy will provide greater opportunity to reach the community.

5.3.1.4 **Revise select land development regulations.** Lower Merion’s current land use standards include some stormwater management provisions that support water quality through the site improvement and development process. The code also encourages communication between the Township and the site designer to develop a stormwater management concept that balances the goals of both the developer and the Township. The 2016 Township Comprehensive Plan states that the Township sees value in expanding the use of GSI in development and redevelopment projects in order to meet community goals for water quality compliance, environmental protection, and community development. It is anticipated that the upcoming Zoning update will reflect these goals by encouraging sustainable development through the use of GSI and LID. The *Recommended SALDO Updates Report* (Appendix A) provides a comprehensive review of land use policy changes. The following select recommendations from that Report are highlighted below as priority actions.

- **Develop thresholds for stormwater management when submitting for Township permits.** When the Township code requires applicants to submit designs for stormwater management (greater than 1,500 SF of new impervious area), all applicants must follow the same process, no matter the size of development. Instead, the Township should create tiered thresholds for impervious area and/or extent of earth disturbance that establish degrees of detail required when submitting designs for proposed stormwater management controls. The varying degrees of stormwater management plan design detail could strike a reasonable balance between the cost of design and engineering, the demand for acreage by required stormwater infrastructure, the pace of land development review, the impact on flooding and water quality, and long-term inspection and maintenance responsibilities.

- **Add landscaping/planting requirements.** The Township code includes standards for landscaping in stormwater basins (§101-12), but not smaller features such as rain gardens, seepage beds, or infiltration swales which are common practice in Lower Merion. The Township code or a Stormwater Design Manual (consistent with the GSI Plan described below in Section 5.3.1.6) should provide design standards, landscaping standards, and planting lists for use in GSI features, detention structures, and parking lots.

- **Add design standards for underground detention.** Underground detention is commonly proposed by Lower Merion developers to manage stormwater on site. The Township should establish minimum standards for design, construction, monitoring, and maintenance of these features in the code to ensure the facility is designed to maximize their function and lifespan.

5.3.1.5 **Expand grant writing/management capacity where appropriate.** Opportunities for additional funding for stormwater improvement projects can be available through grant programs administered by state or federal agencies, private foundations, and others. The Township should build on the successful grant award at Shortridge Park and maintain its capacity to invest local dollars through matching funds or in-kind support. The Economic Development Specialist on staff currently monitors grant opportunities, develops partnerships, prepares grant applications, and administers awarded grants that specifically support stormwater projects towards water quality and community development goals. Should grant availability increase, the Township should consider additional
resources for grant pursuits (both in matching funding and in administrative capacity to pursue and manage opportunities).

5.3.1.6 **Develop GSI Plan and Stormwater Design Manual.** Although Township land development regulations provide standards for design of stormwater management controls, the Township’s preference for managing stormwater using GSI elements is not expressed. Therefore, the Township should prepare a GSI Plan (and accompanying Stormwater Design Manual) for application on Township-owned properties, within the Township’s right of way, and on private property through the development process. This document should define the Township’s:

- Prioritized installation of GSI elements at specific Township facilities that have the potential to improve water quality, moderate runoff rates, or educate the public on stormwater management;
- Operations and maintenance standards for the Township-owned GSI elements;
- Vision for integrating GSI into transportation projects within the Township, County, and PennDOT rights of way;
- Preferred methods for designing, locating, installing, inspecting, and maintaining stormwater management infrastructure linked to land development regulations;
- Incentives offered to private property owners to encourage investment in GSI (grants, loans, flexibility within land development regulations, etc.);
- A map of specific locations on private properties that are ideally suited (based on size, topography, location, etc.) for regional GSI elements;
- Opportunities to gain watershed improvements through Public-Private Partnerships; and
- Methods of communication within Township offices and with the public about the Township’s partnership strategy and policies to work on private properties (including access, cost sharing, and maintenance agreements).

5.3.1.7 **Apply stream assessment data to establish local water quality goals.** Currently, Lower Merion is required to reduce sediment discharge to streams impaired by stormwater runoff by 10%. It is unclear, however, if PADEP will change that standard in the next MS4 permit cycle slated to begin in 2023. For example, the next MS4 permit could increase the sediment reduction goal, or could identify other pollutants of concern that require a PRP.

The Township has access to water quality data collected by PADEP and LMC. Using available data to test assumptions of the current status of impaired waters, could inform the future action by the Township. These actions could include selective increases in stream assessments to verify actual conditions, evaluation of stream restoration projects and the negotiation of MS4 permit water quality compliance goals with regulators.

Use of available stream condition data can guide Township officials on resource allocation to achieve an efficient water quality and stormwater management program that effectively addresses problem areas. Measurable goals will assist Township leadership in dedication of resources, establishment of timelines, and tracking progress.

5.3.1.8 **Prioritize watersheds for action.** Approximately 100 miles of streams flow through the Township’s 24 square miles. Instead of broadly distributing public resources to perform stormwater management tasks across the Township, Lower Merion should prioritize one or two watersheds to focus water quality, flood mitigation, and restoration efforts. While continuing the day to day operations and maintenance activities in all watersheds, the Township would focus pursuit of measurable water quality, infrastructure management, and flood mitigation improvement goals in a more focused way in the select watershed(s). Once progress toward measurable goals is achieved, focus can pivot toward other watersheds. Criteria of selection of priority watersheds could include population density, water quality impairments, pace of development, history of property damage, or infrastructure repair backlog.

5.3.1.9 **Participate in regional communication on water resource issues.** The Township should define the extent of their role to communicate with adjacent communities, PennDOT, Montgomery County,
DVRPC, SEPTA, community and civic groups, and others to create a forum that can investigate opportunities to cooperate regionally on joint stormwater management activities and projects. Examples could include shared contracts providing illicit discharge detection and elimination, joint public outreach and engagement opportunities, regional pollutant reduction structures, or GSI streetscape initiatives. Further analysis of these opportunities is included in the *Future Stormwater Opportunities Report* (Appendix A).

5.3.1.10 Define and implement PCB Pollutant Control Measures. The Schuylkill River is impaired by PCB. The new 2018 MS4 permit requires permittees to address water bodies that are impaired by PCB by preparing Pollutant Control Measures. Lower Merion should understand the limits of PADEP’s regulatory jurisdiction and create appropriately-detailed PCB investigation or mitigation strategies.

5.3.1.11 Assess perflourinated compound sources. Perflourinated compounds (PFCs) are an emerging contaminant of concern. PFCs were added to products to help resist heat, oil, stains, grease, and water. NPDES permittees may in the future need to address sources of this pollutant, similar to how PCBs are addressed now. If required by future MS4 permits, the Township should understand the limits of PADEP’s regulatory jurisdiction and appropriate corresponding actions by the Township.

5.3.1.12 Fund GSI incentive program. Consistent with the recommendation that the Township develop a GSI Plan, the Township should define criteria for directing public funds to implement stormwater management improvements on private property. These criteria will guide investment of Township funds offered as an incentive to private property owners to install stormwater management controls on their property that result in a measurable public engagement, water quality, or flood mitigation benefit for the community.

5.3.2 Cost Center: Operations and Maintenance

5.3.2.1 Operate and maintain stormwater infrastructure. The Township and private property owners have been investing in the community’s storm sewer infrastructure for decades. However, the Township would benefit from more detailed documentation of the condition and management activities of this vital infrastructure system. The Township should take three actions to fill these gaps.

► **Add detail to the MS4 map.** Although the location of over 100 miles of storm sewer is mapped, its condition and ownership is not fully documented. Also, the Township does not have complete spatial data documenting the extent of the system of roadside swales and privately-owned storm sewer that also flow through the Township’s regulated MS4 outfalls. Further, the system changes and grows each year as the Township continues to invest in upgrading the storm sewer and as properties develop and redevelop. The Township should define a process for completing an inventory of all stormwater conveyance and control infrastructure in the Township that includes documentation of the responsible party, size, and maintenance history of critical components of the stormwater conveyance network.

► **Develop, implement, and regularly review a Storm Sewer Maintenance Plan.** The Township has no formal program that directs resources used to maintain the stormwater infrastructure. A Storm Sewer Maintenance Plan, based on a thorough inventory of current system and assessment of current conditions, provides an action plan to be performed to ensure long-term function and protection of the stormwater management and conveyance network. Activities prescribed in the Plan should include street sweeping, inlet cleaning, pipe televideo, and scour inspections at outfalls. The Plan should be reviewed periodically to determine if updates are needed to the list of prioritized activities and to plan for anticipated funding needs.

► **Continue use of mobile data collection.** Mobile data collection is a preferred and cost-effective method of capturing spatial data on infrastructure condition, size, and material. This methodology provides stormwater managers with timely, accurate, and standardized data on
field investigation activities. As the Township defines the pace of adding detail to the MS4 map, they should consider utilizing the Township’s Traisr GIS software to achieve an efficient process.

As an example, the Township’s current method of screening storm sewer outfalls for illicit discharges includes the following steps: 1) Distribute outfall coordinates to the Lower Merion Conservancy (LMC), 2) LMC performs field observations, 3) LMC submits observation data sheets to Township offices, and 4) Public Works staff enter data from paper forms into the GIS.

This process is vulnerable to error as information is transferred multiple times. Instead, the Township should continue using its existing mobile data collection technology to collect data in the field, including photographs, feature conditions, maintenance needs, and more. Mobile data collection enables the field inspector to upload observations directly to a GIS for immediate review and quality control. This process allows the Township to standardize observation input, saves data entry time, and limits transcription errors.

5.3.2.2 Perform good-housekeeping at municipal facilities. Compliance with MCM6 Pollution Prevention and Good Housekeeping as defined by the MS4 permit requires Lower Merion to implement both programmatic and operational activities to protect water quality. Programmatically, the Township is responsible to comply with the three Best Management Practices defined within MCM6. Operationally, the Township must implement activities to prevent the discharge of pollutants via stormwater runoff to local water bodies at municipal facilities. Specific recommendations include the following:

► Regularly review inventory of municipal facilities, including the potential pollutant sources at each site;
► Regularly review written operations procedures (i.e. handling of de-icing material, waste management, equipment cleaning, oil water separator maintenance, and oil transfer), and perform regular inspections to review effectiveness of stormwater and pollution controls; and
► Maintain a regular and targeted employee training program.

5.3.2.3 Storm sewer repair program. Township Public Works crews perform minor storm sewer repairs. However, upon completion of the inventory and assessment of the storm sewer network, the Township should schedule the replacement of inlets and sections of undersized/ deteriorated pipe using a systematic, prioritized, and proactive approach as defined in a future Storm Sewer Maintenance Plan (Section 5.3.2.1). Such a prioritized approach should continue to take into account the annual schedule of the paving program to avoid repair projects within newly-paved streets. Measurable goals, such as the number of inlets repaired annually, will provide the Township with a clearer understanding of progress of the repair program.

5.3.2.4 Sweep streets. In 2017, the Township performed mechanical brush sweeping of all Township streets three times. This process removes leaves, trash, and stones from the curb line to prevent them from clogging storm drains and falling into the storm sewer system. The Township should continue this program annually, documenting program details and problem areas in the Storm Sewer Maintenance Plan. The Township should define the strategy for using the regenerative air sweeper. One strategy could be to use the regenerative air sweeper to follow passes by the mechanical brush sweeper to pick up finer material and prevent discharge of sediment to local streams through the storm sewer. Sediment removal should be tracked and documented to help the Township evaluate the effectiveness of all street sweeping activities.

5.3.2.5 Dedicate funding for vehicle/ equipment replacement. Most Lower Merion departments include a budget line item annually that reimburses the Fleet Division for use of Township vehicles and equipment. The Township should continue this process and add detail by performing an inventory of the vehicles and equipment that have a role supporting the Township’s stormwater program. This inventory can inform the calculation of the full cost of service provided. The Township should also
define the vehicles and equipment that will be needed in the future to support the stormwater program and how those vehicles could be shared to perform multiple Township functions.

5.3.2.6 **Perform storm sewer outfall illicit discharge detection and elimination.** The Township has recently refined the set of outfalls they inspect to fulfill MCM3 of the MS4 permit. The list of outfalls requiring inspection during each five-year permit term should be regularly updated as redevelopment occurs and more information is found out about the system. Specific attention should be given to the task of defining responsibility for inspection of outfalls that might be solely the responsibility of PennDOT, Montgomery County, or a private landowner.

5.3.2.7 **Perform hydrologic modelling of a priority watershed.** The Township has not quantified how water flows through its streams and stormwater system to understand the source and potential solutions to flooding issues in the Township. A hydrologic model will inform the selection and design of capital improvement projects that take into account upstream hydrologic conditions and downstream flow obstructions. To initiate this type of study, the Township should begin by 1) selecting a priority watershed for action (Section 5.3.1.8), and 2) collecting information related to the size, condition, and material of the storm sewer system (Section 5.3.2.9).

5.3.2.8 **Define and implement inspection protocols for private stormwater controls.** The Township maintains a spreadsheet of stormwater controls constructed as part of approved land development plans. The Township code regulations dictate the extent of stormwater control inspection and reporting responsibilities, based on the size of the land development and the date of construction. Table 5 presents the responsibilities of the Township and the property owner to ensure function of each stormwater control structure. Lower Merion should take the following actions:

- Organize the spreadsheet of existing stormwater controls into the categories based on the regulatory requirements presented in Table 5;
- Digitize stormwater controls into a GIS database along with attributes of ownership, type, condition, date of construction, operations and maintenance plan, drainage area, and responsible party;
- Define the Township’s inspection program for each category of stormwater control;
- Establish a process for adding new stormwater controls to the database as they are constructed; and
- Appropriately revise section 121-26.1 of the Lower Merion code to:
  - Define the required frequency of property owner inspections of stormwater controls;
  - Establish a method by which the Township can gain access to the stormwater control to inspect and enforce maintenance is being performed as required; and
  - Require developers to place funds in an escrow account upon completion of site improvements to defray the Township’s costs of periodic inspection of stormwater controls, consistent with Pennsylvania’s model Act 167 ordinance.
### Table 5. Stormwater Control Maintenance and Inspection Responsibilities (with code reference)

<table>
<thead>
<tr>
<th>Stormwater Control Constructed</th>
<th>Constructed on a project with &lt;1 acre of earth disturbance</th>
<th>Constructed under an NPDES Permit for Stormwater Discharges Associated with Construction Activities with earth disturbance &gt;1 acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 3/10/2003</td>
<td>Property owner performs general maintenance (NA)</td>
<td>Township confirms to PADEP that inspection of each stormwater control has occurred during each 5-year MS4 permit cycle (MS4 permit MCM5, BMP#3)</td>
</tr>
<tr>
<td>After 3/10/2003</td>
<td>Property owner performs general maintenance (NA)</td>
<td>Township confirms to PADEP that inspection of each stormwater control has occurred during each 5-year MS4 permit cycle (MS4 permit MCM5, BMP#3)</td>
</tr>
<tr>
<td>After 9/21/2005</td>
<td>Property owner certifies function every 2 years; Township administers certification from property owner (LMT Code 121-26.1)</td>
<td>Township confirms to PADEP that inspection of each stormwater control has occurred during each 5-year MS4 permit cycle (MS4 permit MCM5, BMP#3)</td>
</tr>
<tr>
<td>After 7/18/2007</td>
<td>Property owner certifies function every 2 years; Township administers certification from property owner (LMT Code 121-26.1)</td>
<td>Property owner records maintenance plan on deed (LMT Code 121-4.E.4.b)</td>
</tr>
<tr>
<td>After 11/19/2010</td>
<td>Property owner certifies function every 2 years; Township administers certification from property owner (LMT Code 121-26.1)</td>
<td>Township confirms to PADEP that inspection of each stormwater control has occurred during each 5-year MS4 permit cycle (MS4 permit MCM5, BMP#3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property owner records maintenance plan on deed (LMT Code 121-4.E.4.b, PA Code 102.8.f.10)</td>
</tr>
</tbody>
</table>

**5.3.2.9 Define and implement storm sewer televideo schedule.** Implementation of a defined televideo schedule to assess the condition of the storm sewer network would collect information on the size of storm sewer pipes, the material and condition, elevation, and the presence of illicit interconnections with sanitary or process water. Such a program, based on the National Association of Sewer Service Companies protocols, would identify deficiencies in the system to inform both the Stormwater Capital Improvement Plan (**Section 5.3.3.1**) and the Storm Sewer Maintenance Plan (**Section 5.3.2.1**).

**5.3.3 Cost Center: Capital Investment**

**5.3.3.1 Establish, review, and update the Stormwater Capital Improvement Plan.** Lower Merion has been implementing the prioritized capital stormwater projects listed in the *Township-Wide Stormwater Management Program* for over a decade. The Township should update this Program by converting it into a Stormwater Capital Improvement Plan. This update should include a review of priorities and implementation projects to meet the Township’s goals for runoff control. Sources of information for new projects and establishment of priorities include the inventories of the Township’s infrastructure network, conveyance system capacity studies during the review of redevelopment plans, hydrologic modelling, and water quality monitoring results. Implementation of the Stormwater Capital Improvement Plan should include the following tasks:

- **Design and construct Pollutant Reduction Plan (PRP) projects.** The Township should commit to implementing the streambank stabilization and stormwater basin retrofit projects included in the PRP by 2023. The capital projects required to achieve MS4 compliance and sediment reduction should be evaluated regularly to ensure that the Township is on pace to achieving required sediment reductions.
Design and construct grey infrastructure capital improvements. The Township should continue to invest in traditional grey stormwater infrastructure based on the priorities in the Township-Wide Stormwater Management Program incorporated into a Stormwater Capital Improvement Plan. However, the investment in grey infrastructure may decline as the Township pivots investment to projects that implement the PRP or include GSI elements.

Design and construct GSI improvements. GSI projects can benefit multiple Township infrastructure and development goals related to water quality, flood mitigation, traffic calming, the urban heat island, and property values. Prioritized locations for expanding the use of GSI within the public right of way and at Township facilities should be included in the Stormwater Capital Improvements Plan. These projects should be linked to the GSI Plan which is proposed to set strategies and priorities for how the Township influences GSI installation on private property through the land development process and partnerships.
6.0 PROGRAM TIMELINE AND COST ASSUMPTIONS

6.1 Program Management Strategy
The Township’s Comprehensive Plan recommends that Lower Merion develop a program that “directs investment in innovative methods to efficiently and economically manage municipal stormwater.” Section 5 of this Comprehensive Stormwater Management Plan details 22 projects and activities for implementation that will direct the Township’s future investment in mitigating floods, maintaining infrastructure, and protecting water quality.

However, full adoption and implementation of each project or activity cannot be initiated immediately. Below are three stages the Township may work through to address the projects and activities described in Section 5, targeting full implementation by 2027. Implementation of these recommendations will enable the Township to focus the stormwater program to address both the Township’s current and anticipated stormwater challenges and responsibilities.

Stage 1. Program Continuation.
The first stage of the strategy should include continuation of the existing stormwater program currently provided by the Township’s Public Works, Building and Planning, Administrative personnel, and others, with the following additions:

- Implement the Pollutant Reduction Plan submitted to PADEP that defines the Township’s commitment to specific stream restoration and stormwater basin retrofit projects.
- Develop and implement a public outreach and education program beyond the minimum permit compliance mandates to support the multi-discipline nature of the Township’s stormwater program. This expansion of the program should reach out to residents, stakeholders, and local leaders about the Township’s stormwater challenges and opportunities, seeking their input on priority projects and activities.

The Township should initiate a systematic condition assessment of the storm sewer infrastructure and further analysis of existing water quality in the Township to inform specific project investment in storm sewer operations and capital projects.

- Document the location, condition, size, and maintenance history of the entire Township-owned storm sewer network;
- Define points of interconnection to the Lower Merion MS4 from stormwater systems that are maintained by others (PennDOT, Montgomery County, private properties) as required by the MS4 permit;
- Regularly measure physical, biological, and chemical indicators of stream health within select reaches of streams in the Township; and
- Model how stormwater flows through the Township’s pipes and streams during large storm events to evaluate problem areas and the most effective solution.

This data will build upon the Township’s working understanding of the impacts of stormwater on public safety, property and infrastructure, and the environment. Such assessments of system conditions will provide detailed information required to make optimal investments in future stormwater program activities and projects. Results of investigations will guide priorities for:

- Storm sewer extension/replacement;
- Sediment reduction controls;
- Grey infrastructure repair; and
- Joint GSI projects with private property owners.

An ongoing evaluation of conditions is critical to prioritize investment in innovative methods to efficiently and economically manage municipal stormwater.
Stage 3. Program Investment.
Following input from the public and a detailed understanding of current infrastructure conditions and water quality, the Township can clarify further 1) its target level of stormwater services, and 2) its pace of completing its prioritized backlog of capital projects. These activities and projects should be documented in a Capital Stormwater Improvement Plan and communicated to the public for feedback in the ongoing public outreach program. Ongoing collection of water quality and MS4 condition data, coupled with regular review of progress towards Township stormwater goals, will ensure Township resources are best directed towards the Township's stormwater management goals.

6.2 Pace of Program Change
The three stages described above add to the current stormwater program by initiating a process that regularly seeks public input on Township stormwater management priorities. These priorities are based on a process that expands the knowledge of infrastructure condition, Township facilities, and stream health, and will guide how public resources are distributed to implement the Township’s stormwater program.

Section 5 above details the specific activities and projects that will meet the Township’s stormwater management goals for the next decade. To direct when new and expanded stormwater activities and projects come online, the recommended stormwater program activities and projects are divided into five phases that are based on timing of PADEP’s MS4 regulatory cycle. Figure 6 presents the timing of all recommended stormwater program activities and projects summarized in Table 4. New projects and activities are presented in purple font. The schedule is aggressive, but realistic, with all proposed new activities and projects initiated by 2027.

The new activities and projects proposed to begin in Phase 1 include implementation of the PRP, targeted public education, and targeted land development code updates. Phases 2 through 5 present a progressive expansion of the Township’s stormwater program to take on additional compliance and infrastructure management services over the next ten years. These phases are intended to inform decisions on allocation of Township resources for program administration responsibilities, stormwater operations and maintenance services, and establishment of the Stormwater Capital Improvement Plan to meet community goals for stormwater management.

Implementation of these changes to the Township’s stormwater program makes significant strides in setting the course for the Township’s current approach to one that is more focused and planned, targeting additional investment where it is most needed. The Plan helps position Lower Merion for the future, providing leadership and staff the opportunity to address challenges in the existing stormwater infrastructure while putting into place the necessary information, staffing, and resources to allow for continued improvement.
Figure 6: Recommended Stormwater Program Projects and Activities (new activities presented in purple font)
6.3 Program Cost Projection

The annual funding to implement the stormwater program activities and projects identified in Section 5 and keep pace with the Township’s drivers for stormwater management is estimated to grow from approximately $2.25M in 2017 to $4.63M in 2027.

Figure 7 summarizes how annual stormwater program costs are projected to change through each of the five phases, organized into the three Cost Centers (Section 2.2): Planning and Administration; Operations and Maintenance; and Capital Improvements. The cost projection assumes that Lower Merion will continue to perform existing operational services at the current level (2017). Operations cost projections include an approximate 3% increase annually.

The projected cost to comply with the Township’s MS4 permit are also presented in Figure 7 to specifically demonstrate how Lower Merion’s proposed investment in sediment reduction projects will impact the stormwater program. Streambank restoration projects and stormwater basin retrofits are already proposed through 2022. It is anticipated that GSI projects will be the focus of water quality capital projects to address MS4 requirements in the following phases, beginning in 2023. This will continue the Township’s pivot away from purely grey infrastructure projects. These GSI and sediment reduction projects are assumed to cost more to implement, but have the potential to provide multiple benefits to the community.

There are both known and unknown capital improvement needs and service gaps; this Cost Projection presents a list of activities proposed for the future stormwater program based on current understanding of regulations and infrastructure condition. As Lower Merion implements its Comprehensive Stormwater Management Plan and the program matures, capital projects and services will be adjusted and priorities will change. This change will be informed as more knowledge is gained about the Township’s stormwater responsibilities, surface water quality, and the condition of the infrastructure network.

The Stormwater Program Projection in Appendix A provides greater detail of each element of the stormwater program and applicable cost assumptions. Township leadership should regularly review this information, and adjust the priority status, timing, pace, and frequency of each element to be consistent with Township needs and regulatory requirements.

Notes on relationship of capital investment and MS4-required projects in Figure 7:

- From 2006 to 2016, the Township spent an average of $740K annually on grey stormwater infrastructure to implement the Township-Wide Stormwater Program. Figure 7 projects $740K in Capital Investment will be spent on grey stormwater infrastructure capital projects in 2018. This amount decreases by 50% for Phases 2 through 5 as the Township pivots capital funding to GSI projects and projects that implement the Pollutant Reduction Plan.
- Projected annual Capital Investment directed specifically toward the MS4 requirement to implement the PRP:
  - Phase 1 (2018): $0.19M to design 20% of 2017 PRP projects;
  - Phase 2 (2019 – 2021): $1.52M to design remaining 80% of 2017 PRP projects and construct 80% of 2017 PRP projects;
  - Phase 3 (2022): $1.44M to design 20% of 2022 PRP projects and construct final 20% of 2017 PRP projects;
  - Phase 4 (2023 – 2026): $1.81M to design remaining 80% of 2022 PRP projects and construct 80% of 2022 PRP projects; and
  - Phase 5 (2027): $1.81M to design 20% of 2028 PRP projects and construct final 20% of 2022 PRP projects.
- Cost to design, permit, and/or construct PRP projects to comply with the MS4 permit are projected to average $1.5M annually through 2022; and $1.8M annually from 2023 through 2027.
  - This cost is projected to be 26% of Township’s stormwater Capital Investment costs in Phase 1; 85% – 90% in Phases 2 through 5.
  - This cost is projected to be 60% of the Township’s MS4 permit compliance costs in Phase 1; 90% in Phases 2 through 5.
Figure 7. Summary of Stormwater Program Costs

<table>
<thead>
<tr>
<th>Phase</th>
<th>Capital Investment</th>
<th>Operations &amp; Maintenance</th>
<th>Planning &amp; Administration</th>
<th>Total</th>
<th>MS4 Req.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 (2018)</td>
<td>$0.93M</td>
<td>$1.44M</td>
<td>$0.16M</td>
<td>$2.53M</td>
<td>$0.30M</td>
</tr>
<tr>
<td>First year of 2018 MS4 permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2 (2019 – 2021)</td>
<td>$1.88M</td>
<td>$1.51M</td>
<td>$0.32M</td>
<td>$3.71M</td>
<td>$1.65M</td>
</tr>
<tr>
<td>Phase 3 (2022)</td>
<td>$1.82M</td>
<td>$1.63M</td>
<td>$0.36M</td>
<td>$3.81M</td>
<td>$1.64M</td>
</tr>
<tr>
<td>Last year of 2018 MS4 permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 4 (2023 – 2026)</td>
<td>$2.21M</td>
<td>$1.72M</td>
<td>$0.29M</td>
<td>$4.22M</td>
<td>$1.95M</td>
</tr>
<tr>
<td>Phase 5 (2027)</td>
<td>$2.22M</td>
<td>$1.89M</td>
<td>$0.52M</td>
<td>$4.63M</td>
<td>$2.09M</td>
</tr>
<tr>
<td>Last year of 2023 MS4 permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.0 FUNDING & IMPLEMENTATION OPTIONS ANALYSIS

7.1 Introduction
The purpose of this analysis is to examine the broad range of partnering and funding mechanisms available to Lower Merion Township to support implementation of a Comprehensive Stormwater Management Plan. The analysis presents a general overview of the cost sharing options and revenue generating methodologies. Information includes how each option is typically implemented and the strengths and limitations associated with each revenue source. In addition, the analysis provides an overview of the capacity of each to meet the Township’s funding needs.

7.2 Stormwater Partnership and Funding Strategies
Four strategies can, to varying degrees, increase the cost-effectiveness of stormwater services, generate cash flow, and distribute costs of program implementation across the community.

► **Inter-Governmental Cooperation and Regional Planning.** Sharing services and equipment with neighboring municipalities to achieve economies of scale; participating in regional initiatives to perform stormwater activities on an inter-municipal or watershed basis.

► **Public Private Partnerships.** Partnering with the development community to gain access to strategic locations and implement joint projects for water quality best management practices.

► **Grants.** Applying for grants from state agencies, the federal government, or foundations to support new or expanded stormwater activities and to construct capital projects.

► **Revenue Generation.** Selecting the appropriate mix of revenue sources to fund the stormwater program and distribute costs across the community.

7.2.1 Inter-Governmental Cooperation and Regional Planning
The Township is located in a region with multiple organizations and municipalities whose natural resource protection mission overlaps with Lower Merion. The Township could formalize communication with these groups. Increased communication could enable the Township to raise awareness among residents of regional water quality activities and promote greater involvement in stormwater projects sponsored by other organizations. Through inter-governmental cooperation, municipalities can share the cost of purchasing and maintaining equipment and seek out solutions on a watershed perspective. Cooperative efforts require commitment by all parties and clear communication between each municipality about responsibilities and schedules. Collaborative efforts could include:

► Sharing resources such as vacuum trucks and televideo equipment;

► Sharing personnel to assist with clean-up following storm events;

► Creating joint bid packages to employ a single contractor for illicit discharge monitoring or public works crew training on good housekeeping concepts;

► Performing water resource studies for water quality (PCB, sedimentation) or peak flow modelling at a watershed scale;

► Applying jointly for grant funding for infrastructure improvements or water quality controls;

► Identifying critical areas within the watershed on which stormwater controls could provide regional benefits; and

► Cooperating on the review of land development plans to maximize the effectiveness of up-stream stormwater controls.

Lower Merion could take the lead on setting a meeting and agenda with local municipalities to prioritize regional water resource management issues and take action where cost savings, infrastructure improvements, and water quality protection can occur.

**Limitations:** This strategy may work best for specific, targeted services that are easily quantifiable from a financial commitment or a specific level of service (such as 3-month season for leaf collection
or miles swept, or time-share for a piece of equipment). A coordinator for the shared services is essential to meet cost-sharing terms of agreement.

**Implementation**: Requires coordination and negotiation on the service levels and cost allocations, as well as identification of an administrator of the program/equipment.

**Cost Savings**: Shared costs can reduce the individual community’s operational expenses, creating a savings for each participating entity.

### 7.2.2 Public Private Partnerships

Public Private Partnerships allow communities to use the Township code and comprehensive plan when administering the land development and plan review process to identify partnering opportunities with developers. Communities that partner with developers, institutions, and non-profits can create options for how development occurs and the benefits achieved by the community. The Township could work with development and foundation partners to stretch available funds to:

- Rehabilitate sections of aging storm sewer infrastructure;
- Install regional stormwater management measures on a land development site;
- Reduce effective impervious area discharging to local water bodies by installing GSI;
- Isolate identified sources of PCB as part of the redevelopment of an industrial site; and
- Provide incentives to relocate existing development to areas outside of the floodplain through a Transfer of Development Rights scenario.

By identifying strategic locations and stormwater projects, performing some creative up-front planning in advance of development, and having a willingness to be a collaborative partner with developers, Lower Merion can set a vision for re-development resulting in meaningful stormwater management projects.

**Limitations**: Opportunities to partner are available as development/redevelopment occurs which can be sporadic; thus limiting the ability to reduce overall stormwater costs.

**Implementation**: Requires identification of strategic projects to target for partnering with the development community and may require granting concessions, zoning changes, or variances to development standards or conditions. Long-term operation and maintenance responsibilities are important and should be addressed in a partnering agreement.

**Cost Savings**: Each individual project cost may be privately funded or completed by cost-sharing with the developer, reducing the capital cost of construction for the Township.

### 7.2.3 Grants

Continued efforts to obtain grant awards (from grantors such as HUD, USEPA, National Fish and Wildlife Foundation, Delaware Riverkeeper, William Penn Foundation), can bring in funds for water resource management.

**Limitations**: Grants may be a significant source of funds to enable the implementation of Township projects, but they are limited by a number of factors:
- Grant funding from state agencies is competitive and cannot be counted on for consistency in annual budgeting.
- Grantor priorities may not align with Township needs, and so funding may not be available for annual project implementation.
- Grant programs often look for regional partnerships, matching funds, or shovel-ready projects, requiring significant effort by the Township prior to application submittal.

**Implementation**: Expanding the stormwater focus to Lower Merion’s existing grant pursuit program could include a grant-tracking calendar and active engagement with grantors and the public to communicate Lower Merion’s needs and successes.

**Cost Savings**: This strategy does not include inherent cost savings of program/service costs but does help reduce the revenue needed through taxes or fees to the property owners of the Township.
7.4 Revenue Generation

Many local governments are challenged by the need for funding stormwater management, including state and federal mandates, without adversely affecting other municipal services. In response, municipalities have taken several different approaches to meet their primary revenue needs using local priorities, available funding sources, and citizen support as decision factors.

Standards and limitations exist that influence the viability of different funding mechanisms. As a result, it is important to understand the differences between mechanisms available to support Lower Merion’s program. Stormwater funding mechanisms for local governments in Pennsylvania include taxes (e.g. real estate, per capita, transfer, earned income, emergency services, and business taxes), business license fees, Neighborhood Improvement Districts, and user fees. Each has different underlying principles that guide the structure of the funding mechanism and the use of the revenues.

**General purpose revenues** from Lower Merion’s taxing authority (i.e. property tax, mercantile tax, business privilege tax, local services taxes) fund many traditional governmental services, such as police, fire, libraries, education, and roadways. Their purpose is to provide revenue to fund the expenses of general government, as distinguished from the expense of a specific function or service. It is not necessary for a tax to have a demonstrable association with any particular purpose or function of the local government.

The essential characteristic of a **Neighborhood Improvement District** (NID) as authorized by the Neighborhood Improvement District Act is that it must confer a direct and special benefit to the property being assessed. Local governments use NIDs for a specific purpose rather than a general purpose (such as revenue generated from a real property tax). A common requirement of assessments is a rational linkage (nexus) between the use of the revenue derived from the assessment and the benefit to the party who is assessed. The City Avenue Special Services District and the Ardmore Initiative are existing special assessment districts in Lower Merion established to support community and economic development in their defined districts.

A **user fee** is a charge for the cost of providing the services and facilities (e.g. sewer fees) to properties within the jurisdiction. User fee revenue is tracked through dedicated enterprise accounting that provides a mechanism for receipt and allocation of multiple revenue sources, dedicated to stormwater management. A service fee is imposed on persons or properties for the purpose of recovering the cost of providing service. A rate methodology is adopted to set the appropriate fees and charges. A cost of service study and rate analysis provides the documentation to support the user fee.

### 7.3 Primary Methods of Funding a Stormwater Program

The first three funding strategies identified in Section 7.2 rely on external partners: the willingness of neighboring municipalities to cooperate, the land development process, or the availability of grant funding. Each of these strategies have a role in helping build Lower Merion’s future stormwater program and should be pursued when conditions warrant. However, the remainder of this analysis focuses on the fourth funding strategy, **Revenue Generation** as the principal method for supporting a stormwater program.

The four strategies available to Lower Merion Township are identified as “primary” methods that have the capacity to support the entire stormwater program; and “secondary” methods that are applicable to special needs or situations but are not capable of supporting a full program. The primary support methods (Table 6) can be the sole source of funding for a stormwater program, or could be used in combination with secondary methods that augment use of one or both of the primary funding methods.
Table 6. Methods for Supporting Stormwater Program

<table>
<thead>
<tr>
<th>Primary Methods</th>
<th>Secondary Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Fund Revenues</td>
<td>Inter-governmental Cooperation</td>
</tr>
<tr>
<td>Stormwater User Fee</td>
<td>Regional Planning</td>
</tr>
<tr>
<td></td>
<td>Public Private Partnerships</td>
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<td></td>
<td>State/Federal Grants</td>
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<td>Foundation Grants</td>
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<tr>
<td></td>
<td>Neighborhood Improvement District</td>
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</tbody>
</table>

Local governments across the United States have used all the mechanisms examined, to some degree. Legislative authority and the mission and priorities in each community guide the selection of a preferred approach. There is no single mechanism that is best in every setting. Some funding sources are better suited in support of operations and maintenance, while others are strictly for capital improvements. In Lower Merion, the Township’s existing stormwater management generally relies on the community’s General Fund revenues.

Adequate, consistent resources dedicated to a stormwater management program is more important to the long-term success of the effort than the actual source of revenue. The following discussion provides a brief synopsis of each of the two primary funding mechanisms and their ability to provide a sustainable source of support for Lower Merion’s stormwater program.

7.3.1 General Fund Revenues

The General Fund has a high degree of flexibility to support necessary spending on stormwater programs. General Fund spending is reviewed and re-prioritized annually through the Township’s budget process so that it is consistent with Township goals. It is common practice for the Township to include capital funding for stormwater management projects in its annual budget, as well as funding to support stormwater infrastructure operations.

Using General Fund revenue, generated primarily from various taxes, draws revenue to support local government services disproportionately from some properties and businesses. For instance, some private properties (e.g. parking lots and storage warehouses) have large expanses of impervious area that generate stormwater, but may not pay property taxes commensurate with the potential demands they impose on the stormwater system. Conversely, some properties that have less burden on public stormwater services but a greater property value may be paying proportionately more for stormwater management services through the property tax.

Table 7 presents the estimated cost of Lower Merion’s current stormwater program and the cost of the stormwater programs of several other Pennsylvania communities that currently use General Fund Revenues as the primary funding source of their stormwater programs.

Table 7. Select Annual Stormwater Program Costs in Pennsylvania

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Estimated Annual Stormwater Program Cost (year)</th>
<th>Population (2016)</th>
<th>Area (square miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Merion Township</td>
<td>$2.25M (2017)</td>
<td>58,288</td>
<td>23.8</td>
</tr>
<tr>
<td>City of Easton</td>
<td>$1.17M (2016)</td>
<td>26,978</td>
<td>4.9</td>
</tr>
<tr>
<td>Ferguson Township</td>
<td>$1.78M (2016)</td>
<td>19,350</td>
<td>47.7</td>
</tr>
<tr>
<td>Pottstown Borough</td>
<td>$0.51M (2015)</td>
<td>22,661</td>
<td>5.0</td>
</tr>
<tr>
<td>South Fayette Township</td>
<td>$0.38M (2014)</td>
<td>15,576</td>
<td>20.4</td>
</tr>
</tbody>
</table>
7.3.2 Stormwater User Fees
Stormwater user fees are a dedicated stormwater funding strategy that can provide a municipality with the opportunity to perform long-range planning due to the predictability of the revenue stream. A dedicated source of funding enables municipalities to minimize the amount of funding they need to borrow and avoid future debt service.

The practice of user fee funding for stormwater management programs began in the early 1970’s and currently it is estimated that there are over 2,000 communities who have enacted user fees for stormwater in the US. In Pennsylvania, stormwater user fees in First Class Townships like Lower Merion must be established under an authority structure as enabled by the Municipality Authorities Act. A bill to authorize First Class Townships in Pennsylvania the ability to enact their own stormwater user fee outside of an authority structure is under consideration in the current legislative session (HB 915; Regular Session 2017-18). As many as a dozen user fees are operating in Pennsylvania, with some select examples presented in Table 8.

Typically, stormwater user fees rates are established as a function of impervious area and applied to all developed properties regardless of tax status. This is a significant change in financial policy, shifting the source of funds away from the tax-based revenue of the General Fund, to impervious area on each developed property. This method of revenue generation links the user fee to development intensity of each parcel. User fees impact “who” pays for stormwater and the amount of revenue contributed by each property owner. Tax exempt properties and properties with large areas of impervious surface may likely realize an increase cost of their business. Often, municipalities initiating stormwater user fees recognize the need to establish a comprehensive stormwater education program that informs the community on stormwater challenges, opportunities, and long-term management plans.

Table 8. Select Annual Stormwater User Fees in Pennsylvania

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Single-Family Residential Stormwater Fee</th>
<th>Commercial/ Industrial/ Institutional Stormwater Fee</th>
<th>Total Annual Revenue Generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Allentown</td>
<td>50% of City residents pay $60 or less annually</td>
<td>$20/ 500 SF</td>
<td>$4.8M</td>
</tr>
<tr>
<td>City of Lancaster</td>
<td>Properties with &lt;3,000 SF of IA: 1 of 4 tiers based on IA = $0 - $77 Properties with &gt;3,000 SF of IA: $31 for each 1,000 SF of IA</td>
<td>$96/ 2,400 SF of IA</td>
<td>$2.6M</td>
</tr>
<tr>
<td>Mt Lebanon Township</td>
<td>$96</td>
<td>$96/ 2,400 SF of IA</td>
<td>$1.5M</td>
</tr>
<tr>
<td>City of Meadville</td>
<td>$90</td>
<td>$90/ 2,660 SF of IA</td>
<td>$875K</td>
</tr>
<tr>
<td>City of Philadelphia</td>
<td>$170</td>
<td>$57 for each 500 SF of IA + $7 for each 500 SF of lot area</td>
<td>Values range</td>
</tr>
<tr>
<td>Radnor Township</td>
<td>$29 - $116 4 tiers based on lot size</td>
<td>$29/ 1,500 SF of IA</td>
<td>$1.0M</td>
</tr>
<tr>
<td>West Chester Borough</td>
<td>Properties with &lt;3,000 SF of IA: 1 of 6 tiers based on IA = $40 - $241 Properties with &gt;3,000 SF of IA: $80 for each 1,000 SF of IA</td>
<td>$24/ 3,700 SF of IA</td>
<td>$1.6M</td>
</tr>
<tr>
<td>White Township</td>
<td>$24</td>
<td>$24/ 3,700 SF of IA</td>
<td>$370K</td>
</tr>
</tbody>
</table>

*IA – impervious area

To reduce their user fee, property owners can convert impervious area to pervious area on their parcel or apply to participate in a municipally-sponsored credit program. Municipalities opting to enact a stormwater user fee credit program offer property owners the opportunity to earn credit to reduce their fee by taking action that reduces the cost of the municipality’s stormwater program. Credit options offered can include enhanced stormwater quality treatment and over-control of peak rate stormwater discharge.
7.4 Stormwater Program Funding Discussion
The Township is experiencing an increase in its stormwater management responsibilities. Water quality regulations, residents’ expectations, the cost of operating and maintaining storm sewers, and the frequency of flooding events are all increasing. The Township recognizes that a proactive program for addressing stormwater operations and infrastructure needs to meet these responsibilities is required to efficiently implement the Township’s five guiding stormwater management strategies (Section 5.1):

1. Maintain current services
2. Educate and engage the public
3. Add to the Township’s knowledge base
4. Direct public funds to public interests
5. Demonstrate priorities through land use policies

Ultimately, the decision on how to implement these strategies and how to fund the future program rests with the Board of Commissioners. It is likely that regulatory mandates, program costs, and capital projects will increase in future years. Specifically, a dedicated funding source can enable the Township to more proactively meet its long-term goals for flood mitigation, infrastructure management, water quality, and quality of life needs in the future. Specifically, such a funding source would enable the Township to:

- Define the anticipated annual investment in capital stormwater projects and minimize the need to borrow funds;
- Dedicate funds to be held in reserve for emergency actions;
- Set aside funds to use as matching funds for competitive grant applications; and
- Communicate project priorities to potential partners on capital projects (i.e. adjacent municipalities, PennDOT, institutions).
Appendix A
Select Project Background Documents

Through the process of developing the Comprehensive Stormwater Management Plan, the following reports were developed. Sources of information for these reports included site visits to municipal facilities, document review, staff interviews, and technical research. The documents specifically referred to in the Plan are included here in this Appendix and listed in bold font below. Observations and recommendations included in those reports and documents not included in this Appendix are a resource for the Township’s annual review of its MS4 permit compliance program.

- Minimum Control Measure Compliance Report
- Public Education Recommendations
- Illicit Discharge Detection and Elimination Recommendations
- Preferred Stormwater BMPs for Pollutant Reduction Goals
- Good House-Keeping Recommendations
- MS4 Mapping and Watershed Determinations Report
- TMDL Responsibility Report
- Recommended SALDO Updates Report
- Future Stormwater Opportunities Report
- Stormwater Program Projection *

*Notes:
Average annual cost for the Operations and Maintenance Cost Center in Phases 2 through 5 of Figure 7 of this Comprehensive Stormwater Management Plan is lower by approximately $140K compared to the Stormwater Program Projection (01/17/2018). This reduction is due to the current expectation that contracted street sweeping using mechanical brush sweeping will continue to be the Township’s preferred approach.

The Planning and Administration Cost Center in Phases 3 through 5 of Figure 7 of this Comprehensive Stormwater Management Plan is $60 - $80K compared to the Stormwater Program Projection (01/17/2018). This reduction is due to the decrease in the extent and scope of proposed water quality monitoring program.
A complete and accurate map of stormwater management and conveyance infrastructure is a critical component of a municipality’s stormwater program. An accurate map with the appropriate level of detail will ensure consistency with National Pollutant Discharge Elimination System (NPDES) regulations as administered by the Pennsylvania Department of Environmental Protection’s (PADEP) Municipal Separate Storm Sewer System (MS4) Permit. A thorough map serves as the basis for analyzing options for calculating pollutant load reductions; guides infrastructure operations and maintenance activities; and supports identification of priorities in a capital improvement plan.

The purpose of this Report is to present our assessment of the Township’s existing Geographic Information System (GIS) database for consistency with the standards included in the MS4 Permit. Discussion includes recommendations on the minimum mapping features necessary to meet regulatory standards and where a more detailed GIS could provide the Township with additional tools to manage stormwater infrastructure.

The Township’s stormwater infrastructure GIS shapefiles present the following features. Attributes include construction material, pipe diameter, date of last inspection, and inspection observations.

- 705 stormwater manholes
- 4,451 stormwater inlets/catch basins
- 572 stormwater outfalls
- 102 miles of stormwater pipe

As stated in the 2018 version of the MS4 permit (MCM 3, BMPs 2 and 3), the minimum standard for mapping is as follows:

- The permittee shall develop and maintain map(s) that show permittee and urbanized area boundaries, the location of all outfalls and, if applicable, observation points, and the locations and names of all surface waters that receive discharges from those outfalls. Outfalls and observation points shall be numbered on the map(s).
- The permittee shall develop and maintain map(s) that show the entire storm sewer collection system within the permittee’s jurisdiction that are owned or operated by the permittee (including roads, inlets, piping, swales, catch basins, channels, and any other components of the storm sewer collection system), including privately-owned components of the collection system where conveyances or BMPs on private property receive stormwater flows from upstream publicly owned components.
- Map(s) shall be updated and maintained as necessary during each year of coverage.

PennDOT, PADEP, and the Pennsylvania Department of Conservation and Natural Resources (DCNR) provide shapefiles for public use of the transportation network, surface waters, and aerial imagery that support the Township’s GIS. These shapefiles are stored on the Pennsylvania Spatial Data Access (PASDA) portal managed by Penn State University. Lower Merion utilizes tax parcel data maintained by Montgomery County.

We offer the following recommendations to Lower Merion to add detail to their GIS to support permit compliance, spill response, and infrastructure management activities.
Connect Stormwater Features. Many of the stormwater features included on the Township’s GIS are spatially well connected, showing the flowpath of the manmade conveyance system draining to surface waters. However, 96 stormwater inlets (2%) are spatially located 15 feet or greater from a stormwater pipe. Similarly, 2% of stormwater outfalls to a water body are 15 feet or greater from a stormwater pipe. The Township should connect these features to complete the MS4 map. Some connections may be able to be added to the map through a desktop review of topography, aerial imagery, and street view photos; in some cases, site visits may be needed to gather detail on each feature’s condition, material, size, and flow direction.

The Township GIS should indicate where stormwater infrastructure from neighboring municipalities intersects with Lower Merion’s. These interconnections provide information when defining responsibility for maintenance, spill response, and sediment reductions.

Connect Structural BMPs. Stormwater BMPs constructed as part of the land development process are documented in a spreadsheet maintained by the Township, and should be linked to spatial features in the GIS. The flow path for runoff from both public and private BMPs should be mapped and the Township’s right of access to inspect should be documented.

Define MS4 Outfalls. The GIS presents 572 outfalls from a storm sewer system to a water body, but it is likely that not all are outfalls associated with Lower Merion’s MS4. The Township should review outfalls as discussed in the Illicit Discharge Detection & Elimination (IDD&E) Recommendations (June 1, 2017) and revise the GIS database to differentiate between outfalls that are the responsibility of the Township and outfalls that belong to another entity.

- PennDOT. Of the outfalls presented in the GIS, 25% are within 50 feet of a PennDOT street. These outfalls, as well as others following a review of the completed stormwater map, should be investigated to determine if these outfalls convey runoff from the Township right of way, or only discharge from PennDOT’s system. In the latter case, the outfall would likely not be regulated under the Township’s MS4 permit. The aerial photo in Figure 1 shows a series of five outfalls along Conshohocken State Road (G04130, G04131, G04132, G04133, G04135). PennDOT shapefiles present this road as their responsibility so there may be no role for the Township to manage the stormwater infrastructure within this drainage area as part of its MS4 compliance responsibility. An investigation of the drainage area to each outfall could confirm this concept.
• Industrial permittees. There is at least one industrial stormwater discharge permittee identified by PADEP’s eFACTs system that occurs within the Township (Richardsapex, Inc). This permittee is regulated by PADEP under a different NPDES permit and may maintain its own regulated outfalls. This facility, and potentially others that are not currently participating in PADEP’s program, should be evaluated to define responsibility for stormwater discharge, or if responsibility for maintaining the conveyance system should be shared between the Township and the industrial permittee.

• Private storm sewer systems. Some outfalls included in the Township GIS may only discharge runoff from privately-owned facilities and not carry water from the Township’s MS4. The following recommendation discusses five that have been identified. The Township should document those outfalls that are the responsibility of private landowners and remove them from the list of MS4-regulated features.

**Parse Drainage Areas.** Lower Merion has drafted a map of its MS4 Boundary and Outfalls. This map presents the Township’s parsing of drainage area that limits the Township’s MS4 compliance responsibility on PennDOT right of ways and five private lands (Waverly Care Assoc, Beaumont at Bryn Mawr, Rosemont College, Haverford College, and the Barnes Foundation). These parsed areas were not included in the Township’s sediment loading calculations. PennDOT manages its own MS4 permit and the private lands operate their own stormwater system. However, the Township should investigate further opportunities to parse additional land areas that do not drain to the MS4 or are already covered by an NPDES permit for the control of stormwater.

Using the revised list of outfalls that does not include outfalls of other permittees or solely private outfalls, the Township should delineate the drainage area of only those outfalls associated with its MS4. This will likely reduce the land area on which the Township calculates sediment loading and reduce the Township’s responsibility to reduce sediment discharge.
As an example, the land area from the Merion Memorial Park (Figure 1) may discharge to Gulley Run directly or through a PennDOT outfall; not through the Township’s MS4. In this case this area could be parsed from the Township’s MS4 area and would not be included in sediment loading calculations for the PRP in this watershed.

**Consider Mapping Impervious Area.** The Township’s current PRP calculates sediment loading based on US Geological Survey’s 2011 National Land Cover Database (NLCD). This database provides a spatial presentation of land cover and intensity of development. Land cover is presented in pixels that are 900 square meters, or blocks that are approximately ¼-acre in size. This resolution generalizes land cover within each block, from which impervious cover and sediment loading can then be calculated using county-specific loading rates. Figure 2 displays how blocks of land cover data are distributed across the portion of the Township along Conshohocken State Road.

*Figure 2. NLCD Land Cover Analysis*

The Township should consider increasing the precision of its sediment loading calculation by mapping impervious surface across the Township using aerial photography. Sediment loading to local water bodies based on actual measurement of impervious surface instead of NLCD generalizations would enable a more precise sediment loading calculation and a better understanding of the sources of the sediment flowing to local water bodies. Figure 3 presents the higher degree of resolution of impervious surface mapping (in orange) from another eastern Pennsylvania community on landscape similar to the one shown in Figure 2.
To expedite the impervious area mapping process, the Township could measure impervious area on a statistically significant fraction of its residential parcels to generalize typical impervious cover on residential parcels across the entire Township. Impervious area could be measured on each non-residential parcel in the Township. Impervious area measurement for streets could be calculated based on the Township’s typical widths for arterial, collector, and residential streets.

It is unknown if sediment loading calculations based on an impervious coverage map will result in a higher or lower sediment reduction responsibility. However, such mapping would enable the Township to have more information on the sources of sediment for use when evaluating and investing in structural BMPs that have the greatest impact on improving water quality.

**Revise Pollutant Loadings and PRP.** As the Township gains more information about its MS4 network, existing BMPs on private property, regulated outfalls, land cover, and impervious area, it should consider preparing a revised PRP to submit to PADEP. The above actions may reduce the Township’s baseline sediment load and identify new projects that may be more effective at reducing sediment discharge.

**Expand Attribute Data.** The Township must collect attribute data for each of its stormwater management and conveyance features as required by the MS4 permit. Collecting additional data
for stormwater features would assist the Township with long-term operation and maintenance of stormwater infrastructure. Attributes such as pipe condition, invert elevation, and pipe material are required when performing hydraulic models of the conveyance system. These models can be used to assess the existing stormwater conveyance system, evaluate capacity, and analyze proposed solutions. **Figure 4** below presents a series of stormwater features and the general status of completion as they exist in Lower Merion’s GIS (complete or incomplete). **Figure 4** also presents five stormwater programming and planning activities and the usefulness of each mapping element to implement each activity.

![Figure 4. Stormwater Features Mapping](image)

| Mapping Element | Roads | Inlets | Manholes/Piping | Swales | Inlets/Catch Basins | Outfalls | Public BMPs | Private BMPs | Impervious Surface | Public BMP Condition | Private BMP Condition | Inlet/Catch Basin Condition | Manholes/Pipe Condition | Outlet Condition | Invert Elevation |
|-----------------|-------|--------|----------------|--------|-------------------|---------|-------------|--------------|---------------------|---------------------|----------------------|------------------------|---------------------|------------------|
| Key Required    | ○     | ○      | ○             | ○      | ○                 | ○       | ○           | ○            | ○                   | ○                   | ○                    | ○                      | ○                  | ○                |
| Key Supportive  | ○     | ○      | ○             | ○      | ○                 | ○       | ○           | ○            | ○                   | ○                   | ○                    | ○                      | ○                  | ○                |
| Mapping Status (Complete/Incomplete) | C | C | C | I | C | C | I | I | I | I | I | I | C | I |
| MS4 Notice of Intent | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Pollutant Reduction Plan | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Asset Management | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hydraulic Model | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Stormwater Fee Development | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

**Utilize Mobile Data Collection Apps.** The Township should consider employing a mobile data collection process for any additional stormwater feature attributes added to the GIS. Using common hand held devices, tablets, or smartphones, Township representatives can capture data faster, minimize data entry errors or “typos”, and seamlessly transfer data to the Township’s existing MS4 GIS database. Field data can be compiled, processed, and loaded into ArcGIS to quickly identify discrepancies, if any, and make appropriate adjustments as soon as possible. This data collection method is consistent with the process presented in the *Illicit Discharge Detection & Elimination (IDD&E) Recommendations* (June 1, 2017).

**Establish Update Process.** As land development and redevelopment occurs, the Township should identify responsible parties for maintaining the GIS database of stormwater features and define a process for adding new structures installed both on private and public land. This process should include a policy for adding details of constructed stormwater features from previously approved grading and land development plans to the stormwater map, including invert elevations, pipe size, slope, and construction material.
**Develop Infrastructure Operations Plan.** A comprehensive stormwater map and a working hydraulic model of the stormwater system would be useful tools for planning management of the infrastructure network. The Township should consider creating a stormwater network operations plan to set goals and priorities for system clean-out, televideo, conditions assessment, pipe replacement, outfall maintenance, and catch basin upgrades. Specific problem areas identified and quantified through this process would inform capital improvement planning and provide information for negotiations with developers that propose improvements that would affect the stormwater network.
Every two years, states submit an update to their list of water bodies that do not meet water quality standards to the US Environmental Protection Agency (USEPA). This list of impaired waters is required by the Clean Water Act of 1972, specifically Section 303(d). The 303(d) list provided by each state includes the reason for the water quality impairment, which may include point sources (i.e. industrial or sewage discharges) or non-point sources (i.e. abandoned mine lands or agricultural runoff), and the pollutant causing the impairment, such as metals, pH, mercury, or siltation. Section 303(d) also requires states to identify a schedule for addressing the sources of impairment by developing a Total Maximum Daily Load (TMDL) for each listed water body. A TMDL quantifies the threshold of pollutant loading to a waterbody that will enable the water body to meet target water quality standards.


MS4 Permit Requirement
PADEP uses the Integrate Report as part of its administration of the Municipal Separate Storm Sewer System (MS4) permit. The MS4 permit authorizes municipalities in urban areas to discharge stormwater into local water bodies. MS4 communities that discharge to a water body listed on the Integrated Report that is impaired by urban runoff and under an approved TMDL with an assigned wasteload allocation, are required to develop and implement a TMDL Plan to reduce the pollutant of concern. Permittees seeking MS4 authorization to discharge to a water body on the Integrated Report that is impaired by urban runoff but without a TMDL plan, are required to develop a Pollutant Reduction Plan (PRP). An MS4 permittee’s TMDL Plan or PRP commits the permittee to take action to improve water quality in the impaired water body.

Table 1 presents the streams identified by PADEP that flow through Lower Merion Township. Most of these streams are included on the Integrated Report and are shown as having impaired water quality. Table 1 also presents the cause of impairment as provided by PADEP. Based on the 2018 MS4 permit requirements, those streams impaired by urban runoff will require the Township to develop a PRP. PADEP has set the standard that implementation of a PRP for streams impaired by urban runoff should reduce sediment discharge to the stream by 10% over the 5-year permit cycle (2018 to 2023).

TMDLs in Lower Merion
An adopted TMDL Plan identifies the reduction targets for the specific pollutant of concern causing the impairment in a water body. The TMDL distributes the wasteload allocation to permittees that are authorized to discharge under a National Pollutant Discharge Elimination System (NPDES) permit (i.e. MS4, industrial stormwater, industrial point source). The wasteload allocation sets the limit for the discharge load of the pollutant of concern from each permittee’s discharge. Each
permittee receiving a wasteload allocation must prepare a compliance strategy that is consistent with the TMDL Plan that identifies the methods to achieve targeted pollutant reduction.

Two TMDLs have been completed for Lower Merion streams. However, the source of the pollutant of concern for each of these TMDL streams is not the Township’s MS4. Therefore, Lower Merion is not responsible to develop a TMDL Plan to address these impairments.

- **Schuylkill River PCB TMDL** – Lower Merion’s responsibility to take action to address PCB is limited to the activities described in Appendix C (Pollutant Control Measures for Waters Impaired by Priority Organic Compounds) of the MS4 Permit. These include:
  - Develop a map of the storm sewer that discharges to the River;
  - Develop an inventory of suspected and known sources of PCB in stormwater within those drainage areas;
  - Investigate each suspected source;
  - Notify PADEP if the suspected source may be discharging via stormwater; and
  - Document progress of investigations and source controls.

- **Glanraffan Creek Metals and Sediment TMDL** – USEPA approved a TMDL for the Glanraffan Creek in 2003 following listing of the stream on the 1996 Integrated Report. The stream is impaired by high levels of metals resulting from leachate from a closed landfill. The Township has taken action to remove iron, sediment, and other metals using a passive treatment remediation system near the point where groundwater surfaces from the abandoned landfill and before it discharges into the stream. The Township’s MS4 permit does not require Lower Merion to take additional action to address this TMDL at this time.

Table 1 presents PADEP’s proposed date for creating TMDLs to allocate wasteloads to permittees for each impaired stream. Although several streams are shown to have a TMDL completion date of 2015, it is our understanding that these TMDL studies are not proceeding. Further, no Lower Merion streams are included on PADEP’s current list of priority streams for TMDL development. PADEP action on developing these TMDLs is not anticipated at this time. However, PADEP must at some point develop strategies for improving water quality in each stream towards the goal of removing it from the Integrated List. Therefore, unless Lower Merion’s streams achieve their water quality standards, they will remain on the Integrated Report, which may trigger PADEP to perform a TMDL study, assigning specific and mandatory pollutant reductions to Lower Merion’s MS4 discharge.

**Ithan Creek Watershed** - Instead of performing a TMDL study and allocating wasteload allocations to permittees, PADEP has initiated an Alternative TMDL process. The Ithan Creek, is one of 16 select watersheds in Pennsylvania included on the alternative TMDL list that PADEP submitted to USEPA. The Ithan watershed drains very small portions of the Township (stretches of Norwood Road, Airdale Road, Claremont Road).

The process of developing an alternative TMDL accounts for each watershed’s unique set of characteristics (i.e. topography, land use, population, development pressure, stakeholders) while pursuing long-term water quality improvements. The intent of the alternative TMDL process is to provide MS4 permittees with an option to improve water quality outside of a stringent TMDL compliance program. MS4 communities volunteer to establish and commit to achieving long-term water quality goals on an achievable timeline, often working at a multi-municipal, watershed scale.
PADEP states that it intends to develop water quality strategies for alternative TMDL watersheds by 2022. The strategy for the Ithan Creek could add compliance responsibilities to Lower Merion’s MS4 permit. PADEP provides the following rationale for why it included the Ithan Creek on its list of candidate watersheds for the development of an alternative TMDL plans:

This watershed’s siltation impairments are largely associated with Urban Stream Syndrome. The Ithan Creek watershed is included in the William Penn Foundation’s Delaware River Watershed Initiative/Upstream Suburban Philadelphia Cluster Improvement Plan. The Plan provides funding for stormwater restoration and monitoring which makes Ithan Creek a good candidate for a TMDL alternative.

**Lower Merion’s Responsibility**

The 2018 MS4 Permit renewal is the first permit cycle where permittees are required to implement measurable water quality improvements outside of TMDL watersheds. PADEP’s *MS4 Requirements Table* (8/10/2017 version), which lists the impaired water bodies in Lower Merion and defines the Township’s responsibility to develop PRPs, is based on the Integrated Report. Table 1 presents the Township’s responsibility for developing a PRP as defined in the *MS4 Requirements Table* and information on the source of each impairment. For those streams requiring a PRP, the Township is required to achieve a 10% reduction in sediment discharge from the MS4 by 2023.

It should be noted that although Gulley Run is listed as impaired by urban runoff and storm sewers, PADEP is not requiring Lower Merion to develop a PRP.

In contrast, PADEP states that the Glanraffan Creek is impaired by an abandoned landfill, yet PADEP’s *MS4 Requirements Table* states that Lower Merion should develop a PRP to address sediment generated via stormwater runoff. The Township is already addressing the impairment defined by the Glanraffan Creek TMDL through a water treatment system that addresses the abandoned landfill as a point source. Although PADEP requires a PRP for the Glanraffan, it does not meet the criteria laid out in Appendix E (*PRP Requirements for Discharges to Waters Impaired for Nutrients and/or Sediment*) of the MS4 permit. It is not clear why a PRP is required to manage MS4 discharge when the MS4 is not the documented source of the water quality impairment. Therefore, treatment of the Glanraffan watershed could be removed from the PRP, including removal of its land area from the baseline sediment loading calculation.

PADEP anticipates that water quality improvements in streams in urban areas require a long-term process. Water quality degradation that occurred over decades will require decades to restore. Therefore, PADEP may use subsequent versions of the MS4 permit starting in 2023 to require additional sediment reductions in impaired streams beyond the current 10% goal.

PADEP has also stated that they are open to MS4 permittees offering their own stormwater quality compliance plans that do not follow the template prescribed in the PRP instructions. Such an alternative plan could set water quality metrics that account for Lower Merion’s specific circumstances. For example, the Township may wish to focus watershed restoration efforts on a single prioritized watershed, instead of scattering stormwater controls across the multiple watersheds. Such a Township-initiated plan could describe a strategy to begin work in a second watershed and so on until all streams have achieved measurable water quality improvements consistent with NPDES standards.
### Table 1. Lower Merion Water Quality Summary

<table>
<thead>
<tr>
<th>Stream</th>
<th>Assessed Use</th>
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<th>PRP Required</th>
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* TMDL study not performed
The purpose of this Report is to identify potential revisions to the Township’s land use policy and regulations that could improve the design of stormwater management features proposed during the land development plan process.

The Township’s current Subdivision and Land Development Ordinance (SALDO) (Chapter 135 of Lower Merion’s code) provides standards for processing land development plans (Article III), plan content (Article IV), and General Standards for land development (Article V). The SALDO includes minimum standards for how improvements are constructed, but just as importantly, defines the process of designing and laying out a land development plan. Examples of stormwater-related requirements in the SALDO include standards for delineating stormwater management areas in the sketch plan (§135-16), prohibition of stormwater diversions (§135-39), and proper discharge of roof drains (§135-41). These SALDO provisions are supplemented by concepts and standards included in other Township policy documents, primarily the four presented below:

- Township Comprehensive Plan;
- Natural Features Conservation Code (Chapter 101);
- Stormwater Management and Erosion Control Ordinance (Chapter 121); and
- Zoning Ordinance (Chapter 155).

Like many communities across the country, Lower Merion is considering the integration of Low Impact Development (LID)/Green Stormwater Infrastructure (GSI) practices into their stormwater management program. There are multiple drivers for the use of GSI/LID. These key drivers include the Municipal Separate Storm Sewer System (MS4) permit under the National Pollutant Discharge Elimination System (NPDES) and the desire of residents and business for a set of water resource management policies that may also promote quality of life, economic development, and environmental stewardship. However, many questions arise when considering the policy changes to promote the use of GSI/LID such as:

- Should GSI/LID be required or encouraged?
- What incentives may be meaningful to developers?
- Where are GSI practices not appropriate?
- Are small-scale GSI practices desired on residential lots?
- Do GSI/LID concepts conflict with existing Township regulations (i.e. weed control, parking design)?

Lower Merion’s current land use standards include some stormwater management provisions that support water quality through the development process. However, the Comprehensive Plan states that the Township sees value in expanding the use of GSI in development and redevelopment projects in order to meet community goals for water quality compliance, environmental protection, and community development.

**Lower Merion’s MS4 Responsibility**
Specifically, Minimum Control Measure (MCM) 5 Post-Construction Stormwater Management in New Development and Redevelopment of the 2018 version of the Township’s MS4 permit will require the Township to:
• Enact, implement and enforce an ordinance to require post-construction stormwater management from new development and redevelopment projects, including sanctions for non-compliance.
• Develop and implement measures to encourage and expand the use of Low Impact Development in new development and redevelopment. Measures should also be included to encourage retrofitting LID into existing development.
• Enact ordinances consistent with LID practices and repeal sections of ordinances that conflict with LID practices. Submission of an ordinance that is consistent with DEP’s 2022 Model Stormwater Management Ordinance will satisfy this BMP.

MCM 5 maintains the requirement to include GSI/LID concepts in land use regulations from the 2013 version of the MS4 permit. For the 2018 version, PADEP has offered a Model Stormwater Management Ordinance as sample language of how permittees can update their land use regulations to comply with their permit responsibilities. Lower Merion is required to adopt an acceptable version of this Model Ordinance (which also includes prohibitions for non-stormwater discharges from the MS4 [MCM 3] and erosion controls at construction sites [MCM 4]) by 2022.

Ordinance Overview
Lower Merion’s land use regulations are found in a number of policy documents and regulations that were reviewed for this Report. Impervious surface limits are included in the Zoning Ordinance, general land development standards and review processes are provided in the SALDO, riparian buffer protection are in the Natural Features Conservation Ordinance, and specific stormwater management design targets are included in the Stormwater Management and Erosion Control Ordinance. In addition to these codified regulations, activities performed by property owners that do not qualify as land development, may trigger the need for a Township land disturbance permit.

A cohesive set of municipal stormwater management regulations for land development integrates both stormwater quality and quantity management. The Township’s policies must be aligned with the local drivers (regulatory, environmental, flood protection, etc.). Regulations should provide clear guidance to developers on standards for improvements. And every aspect of plan review, plan approval, construction inspection, and long-term stormwater facility operation and maintenance should be clearly stated.

The following sections ask questions about the Township’s current land use policies and regulations to support the Township’s comprehensive set of stormwater strategies.

On August 30, 2017, Nathan Walker and Kobby Addo-Boateng from Amec Foster Wheeler joined Robert Duncan, Andrea Campisi, and Carissa Hazleton from Lower Merion Township and Kevin Bowers from Pennoni at the Township office to discuss the preliminary version of the Recommended SALDO Updates Report (8/24/2017). This document reflects the feedback provided by the Township staff and their priorities we discussed.

This is only the beginning of the process establishing GSI/LID elements in the Township’s stormwater management standards. Once elements are prioritized for inclusion in the Township code or as a matter of administrative practice, effort will be required to tailor each element into a regulation or incentive that best meets Township goals. It will be advantageous to employ a stepwise method of integrating the highest priority GSI/LID elements into the land development permitting process. Such a methodology will allow land development stakeholders, the public, and Township staff time to:
  • Adequately identify and understand stormwater management drivers;
• Determine appropriate levels of regulation;
• Remove impediments to implementing GSI/LID; and
• Include possible incentives and regulatory changes.

Administration and Policy
• How will the public accept GSI/LID concepts? The challenge of expanding the use of GSI/LID and understanding potential effects on developers, local governments, and the general public is a topic of great interest and a priority for communities throughout the United States. Integrating GSI/LID requirements into local standards and then promoting implementation requires local municipalities to be proactive in addressing how changes will affect the multiple groups of stakeholders across the community. Therefore, communities adding GSI/LID elements to their land use planning often establish public education and outreach programs. Such a program in Lower Merion could be appropriately branded to program goals, and should be inclusive of the multiple target audiences, both internal (staff) and external (stakeholders). A GSI/LID Public Education and Outreach strategy could be developed in conjunction with the Township’s MS4 Public Education and Outreach requirements.

• Are standards consistent between the ordinances? Consider consolidating requirements dictating the design process and minimum design standards into a single ordinance wherever possible. This could include relocating sections of the SALDO describing stormwater management design to the Stormwater Ordinance.

• Are definitions and standards consistent between ordinances? As an example, the definition for ‘Land Development’ differs between the PADEP Model Ordinance, the SALDO, and the Stormwater Management and Erosion Control Ordinance. The Township should remove duplicative standards to avoid the need to make revisions in multiple sections (compare stormwater pipeline design standards in §121-4.F.2 and §135-41.F) if standards change.

• Should as-builts be submitted for completed stormwater infrastructure? Township ordinances currently require as-built drawings for telecommunications, sidewalks, floodplain development, and sanitary sewer extensions. The Township could add a statement to allow for the township reviewer to have greater discretion for requiring as-built CAD files for stormwater management features installed by developers and add them into their spatial database. As-builts for stormwater management features treating greater than a Township-defined land area threshold or with complex installation or maintenance requirements should be prioritized.

• Who follows up on approved operations and maintenance (O&M) plans? The SALDO (§135-41) requires the property deed to state the responsible party for maintaining the function of conveyances and stormwater controls. The Stormwater Ordinance also includes this provision and adds detail related to the contents of the maintenance plan (§121-4). Operations and maintenance standards for stormwater infrastructure, including GSI/LID should apply to approved land developments, as well as Minor Grading Permits and Runoff and Erosion Control Permits. Standards for the content of each plan should specify activities necessary to maintain all features, including headwalls, underground conveyance, vegetation, energy dissipaters, and security fencing. The Township should:
  o Map each stormwater control;
  o Document association with an NPDES permit for earth disturbance activities;
  o Link the approved plan and any agreement in the GIS;
  o Document schedules for inspection and maintenance; and
  o Document the Township’s right of access.
Does a Municipal Stormwater Maintenance Fund exist? Pennsylvania’s model Act 167 ordinance includes a section that permits municipalities to require developers that are installing stormwater storage facilities to pay into such a fund to defray costs of periodic inspections and maintenance expenses for ten years; or to fund long-term maintenance of the stormwater control. The Township should consider codifying this requirement. Examples of Pennsylvania municipalities that utilize this provision are Radnor Township (§245-39), Swarthmore Borough (§1459.072), and Cheltenham Township (290-18).

Are waivers to stormwater management standards tracked? PADEP requires a report of the number and type of waivers MS4 permittees grant to permit an exception to the non-stormwater discharge provision required by the MS4 permit (MCM 3, BMP #5). Such a report should be created for regular submittal to PADEP; and as a tool for the Township to periodically review to see if specific sections of an ordinance are regularly waived and might need to be revised.

Is a fee in lieu of stormwater management an acceptable alternative to a structural control? Some Montgomery County municipalities accept a fee in lieu of stormwater management instead of requiring small structural controls that serve small areas of impervious surface. In a fee in lieu program, fees collected are used by the local government to construct public stormwater projects. The developer is often required to demonstrate that it is technically infeasible to meet the stormwater management requirements at the regulated site before requesting the fee in lieu option. The amount of the fee can be based on the cost necessary to construct the stormwater control as well as the cost of operations and maintenance. Other municipalities have instituted a fee applied to developments based on the linear footage of newly constructed or replaced curbing within the public right of way. Lower Merion’s solicitor should review the Township’s authority to add fee in lieu or impact fee requirement to land development standards.

Permit Applicability

Are permit thresholds appropriate? The Township requires stormwater management for all land development permits for the following:

- When greater than 50% of vegetation is removed from a parcel (§101-5.B.1.c);
- For any impervious area greater than 1,500 square feet (§121-2); or
- When residential lot owners are given approval to exceed the impervious cap included in the zoning district (§155-141.5).

When stormwater management is required, all applicants must follow the same process, no matter the size of development. Instead the Township could elect to create tiered thresholds for impervious surface or earth disturbance that establish degrees of complexity of stormwater management. The tiered structure of complexity could strike a reasonable balance between the cost of design and engineering, the demand for acreage by required stormwater infrastructure, the pace of land development review, the impact on flooding and water quality, and long-term inspection and maintenance responsibilities. The Township should review permit applicability and thresholds requiring stormwater management to close loopholes that may allow developers to avoid managing all existing impervious area.

Is repaving earth disturbance or land development? Repaving an existing parking lot may include simple top-coating, milling to the sub-base, or excavation to the sub-grade and complete replacement. The Township should consider what thresholds of the extent and degree of repaving (mill & overlay vs. full depth replacement) should qualify as a regulated earth disturbance or fall under the definition of a new impervious surface and how that triggers the need for stormwater controls.
**Design Process**

- **How are site design decisions documented?** The Natural Features Conservation ordinance requires developers to prepare an impact assessment to evaluate the on-site and off-site impacts of proposed improvements (§101-14.B). Consider adding to this requirement the responsibility to document all non-structural stormwater management controls considered, a discussion of alternative stormwater management controls considered, and why these controls were not in the design selected for implementation.

- **Can sketch plan submittal be further encouraged and expanded?** The SALDO offers a process for applicants to submit a tentative sketch plan, which is required for projects proposing greater than five acres or eight dwelling units (§135-7). The Township should consider reducing the threshold at which sketch plans are required to promote early review of the types of projects commonly submitted by developers. The Township could also consider requiring a sketch plan for those areas of the Township that have high potential for managing stormwater upon which regional stormwater planning could be beneficial. When the process occurs early in the site planning process, ideally before the extent of grading and the site layout (buildings, pavement, and open spaces) are determined, the following benefits of a sketch plan process to promote GSI/LID elements could include:
  - Incorporation of a site’s natural hydrologic features into the design;
  - Maximized use of GSI/LID practices, and potentially minimize the need for constructed drainage features to meet stormwater performance standards;
  - Decreased need and cost for construction, materials, and long-term maintenance;
  - Facilitated communication between the applicant the Township leading toward a more efficient plan review process;
  - A forum to discuss potential variances to development standards requested by the applicant;
  - An opportunity for the Township to negotiate improvements with the applicant (i.e. reduced parking for attending, reduced gross floor area ratios, etc.)

- **Should stormwater management near sources of contamination be more protective?** The Stormwater Ordinance already identifies hotspots as areas where infiltration of stormwater may be prohibited to prevent mobilization of contaminants in the groundwater (§121-4.E.2). Similarly, the Township could consider adding greater runoff management standards in areas where water quality or soils data data shows susceptibility to high rates of streambank erosion or to parcels that are high contributors of sediment to local water bodies.

- **Could a green score card incentive promote better stormwater management?** The Township could add a program to award “green points” to development for use of LID techniques and GSI practices. The points system could be developed specifically for Lower Merion and their specific sustainability goals or could be based on a nationally recognized point program like Leadership in Energy and Environmental Design (LEED), or the Envision Rating System. The Township could offer applicants with land development plans that score well incentives related to parking, buildable area, setbacks, or building height. Such an incentive program already exists to allow for flexibility in setbacks, building area, and impervious surface for historic resources (§155-152). The Township drafted a scoring system related to water quality for discussion purposes during the Comprehensive Planning process.

- **How can the Township promote favored stormwater management BMPs?** The *Preferred Stormwater BMPs for Pollutant Reduction Goals* (June 23, 2017) provides scoring of BMPs based on their ability to meet the Township’s water resource management goals for sediment reduction and annual maintenance. During the land development application process, the Township should direct applicants toward these
preferred BMPs. The Township could document its preferences for stormwater management in a stormwater design manual. Such a manual can address all aspects of stormwater management controls, before, during, and after construction, on a land development site, including:

- To inform applicants of the Township’s preferred methods for managing stormwater, such as daylighting streams;
- The application of specific GSI/LID elements, porous pavement, and designs of controls proven to be practical from an operations and maintenance perspective; and
- Options for disconnecting impervious surface building on the Zoning Ordinance classification of pathways in the Impervious Surface definition (%155-4).

• How can the Township promote favored locations for BMPs? Applicants submitting a sketch plan shall describe areas to be set aside for stormwater management (%135-16.B). However, no standards are included on preferred locations for these controls. The Township should consider adding statements to encourage the installation of stormwater management infrastructure on areas of the site that are most conducive to infiltration, could help to manage off-site runoff, utilize green space, or avoid excessive grading. If there are specific areas the Township believes are well-suited for stormwater, these could be included on the Township’s Official Map or listed in a design manual.

**Stormwater Conveyance and Management Design**

• Does oversight occur of the critical stages of installation? Section 102.8 of PADEP’s Erosion and Sediment Control regulations require a licensed professional to be present during critical stages of installation of post-construction stormwater management features on NPDES-permitted sites. The Township should enforce documentation of this construction oversight.

• How are sediment reduction calculations documented? The Township should consider requiring developers adding over a specified threshold of impervious area to calculate 1) the existing sediment discharge flowing via stormwater runoff from the site proposed for development, 2) the reduction achieved by new BMPs installed during the land development process, and 3) the value of any sediment reduction achieved above the minimum required that could be applied to the Township’s sediment reduction goals.

• Should different water quality standards apply to the four stormwater management districts? The Township administers four stormwater management districts (%121.4.B) that define stormwater release targets to manage discharge from new development. Likewise, the Township could develop water quality treatment standards for each district to address specific sources of pollution and promote preferred stormwater controls based on the area’s land use, soils, and topography. This concept already included in the provisional infiltration only district could be expanded. The water quality volume required to be treated could be higher in districts where water quality is poor as determined by water quality sampling and stream inspection data.

• Should different water quality standards apply to different watersheds? In addition to already-defined stormwater management districts, the Township may wish to apply different water quality treatment standards to specific watersheds (i.e. the Provisional Infiltration District). Rationale for setting different standards for water quality treatment in different watersheds could be based on actual in-stream water quality data or on land cover, tree canopy, or impervious surface measurements.

• Should the Township add specifications for underground detention design? Underground detention is commonly proposed by Lower Merion developers to manage stormwater on site. The Township should establish minimum standards for design,
construction, monitoring, and maintenance of these features to ensure the facility is designed to maximize their lifespan.

- **Has the option to expand impervious surfaces above zoning caps been utilized?** The Zoning Ordinance allows some residential units to exceed the maximum permitted impervious surface of the zoning district so long as 100% of the stormwater runoff from the addition is recharged for the 100-year storm event (§155-141.5.c.2). The Township should track the use of this ordinance provision to assess if the resulting stormwater controls are being maintained and able to meet the performance standard.

**Parking and Transportation**

- **Do street, curb, and sidewalk standards enable space for GSI installation?** The Township establishes minimum street widths (§135-27), requires curbs on all streets except next to large lots with deep setbacks, and generally mandates that sidewalks are to be located as far as practicable from the curb (§135-28). The Township should consider amending these standards so that certain stormwater controls can be implemented within the right of way. Smaller paving widths, the ability to avoid construction of curbs, and standards for green space between the road and the sidewalk will allow for GSI/LID elements like vegetated swales and tree trenches to be installed in the public right of way, while also providing traffic calming and heat island reduction benefits. The Township should review existing right of way and street standards and prioritize opportunities for GSI/LID installation. If more GSI/LID features will be installed in the right of way, the Township should define if these features should be offered to the Township for dedication and the responsible party for on-going maintenance (Township, developer, PennDOT, county). Such technical guidance for GSI/LID design in the right of way could be included in a Township stormwater design manual (e.g. GSI/LID typical details including curb turnouts, bioretention bumpouts, etc.) or addressed in the upcoming Zoning Ordinance update.

- **Should the Township include standards for porous paving and grass pavers?** The definition of Impervious Surface in the Zoning Ordinances states that pathways six feet or narrower employing grass pavers or porous paving should not be considered impervious. The Township should consider adding minimum standards for the design, installation, and maintenance of these features to make sure they are not a source of accelerated runoff.

- **Can the Township’s parking calculations flex to allow for reductions in required spaces?** The Township provides tools for property owners to establish shared parking arrangements (§155-87.23.E) and hold parking in reserve (§155-95.1). Both of these tools allow property owners the opportunity to reduce their total impervious surface footprint. The Township should review shared parking and parking in reserve arrangements to calculate the number of parking spots avoided. This analysis and review of minimum ratios may reveal which land uses have parking ratios that are too high. Revisions to parking ratios may give property owners flexibility in land use decisions which could lead to measurable reductions in impervious surface.

- **Do parking lot design standards allow for GSI installation?** Lower Merion includes its parking lot landscaping standards in the Natural Features Conservation Ordinance (§101-9.B). Standards include minimum sizes for parking islands and border area width. The Township should consider amending design standards to ensure landscaped areas associated with parking lots are large enough to accommodate GSI/LID and to promote the use of depressed landscaped areas and rain gardens so they can receive and treat stormwater.
**Land Cover, Land Use, and Landscaping**

- **Are impervious surface caps consistent with stormwater management goals?** If the Township proceeds with mapping impervious surfaces, they can assess each parcel’s consistency with impervious surface caps established by individual zoning districts. These regulatory caps and measure of actual impervious surface can be reviewed against the presence of downstream water quality impairments addressed in the Township’s Pollutant Reduction Plan. The calculation of sediment discharge from existing impervious surface and impervious surface constructed at the greatest potential build-out condition of the zoning district could show how existing land use regulations affect stream health. The Township could consider amending the Zoning Ordinance by revising impervious surface caps, adding incentives to encourage property owners to reduce or disconnect existing impervious surface, or adding incentives to voluntarily remain under a lower impervious surface threshold when improving a property.

- **Does the Natural Features Conservation ordinance provide guidance to promote GSI?** The ordinance includes standards for landscaping in stormwater basins (§101-12), but not smaller features such as rain gardens, seepage beds, or infiltration swales which are common practice in Lower Merion. The Township ordinances or a stormwater design manual could provide design standards, landscaping standards, and planting lists for use in GSI/LID features.

- **How does the Township code promote vegetated riparian buffers?** Both the Natural Features Conservation Ordinance and the Floodplain District in the Zoning Ordinance could be used to improve the water quality function of stream buffers. In addition to the use standards in the Zoning Ordinance (§155-157), these ordinances could include:
  - Recommended or required buffer width;
  - Standards for restoration following development;
  - Preferred plant lists;
  - Minimum canopy density;
  - Mandatory inspection cycles; and
  - Long-term vegetation management plans.

  PADEP’s MS4 2022 model Stormwater Management Ordinance provides example language for protecting riparian buffers that has some applicability in Lower Merion (Section 305).

- **Does the Brush, Grass and Weeds ordinance deter GSI/LID?** The Township prohibits any weeds, tall grass or other objectionable vegetation exceeding 12 inches in height as a health hazard and nuisance (Chapter 59). To promote the establishment of native grasses and soils that can infiltrate stormwater, the Township should consider revising the Brush, Grass, and Weeds ordinance by adding exceptions for GSI/LID.
The purpose of this report is to describe a set of five opportunities the Township has to influence installation of stormwater controls on land they do not own. This Report recommends how to proactively define the Township’s preferences for adding stormwater management controls on private land. The Township can then communicate, early in the site design process, clear expectations of stormwater management strategies with property owners, developers, civic organizations, and state and county agencies.

The Township’s primary tools to add stormwater runoff controls are structural Best Management Practices (BMP) that reduce velocity, filter pollutants, and increase infiltration into groundwater. The Township actively maintains the function of its existing public stormwater conveyance and management network. In addition to installation of streambank restoration at Township parks, Lower Merion has implemented new BMPs in recent years such as upgrades to stormwater management infrastructure within the public right of way (ROW) and at Township facilities. However, the Township does not have the direct ability to add or improve existing stormwater management runoff controls or water quality treatment practices on land they do not own.

On private land, staff have tools to enforce the operation and maintenance of existing privately-owned infrastructure. The Township can apply land use regulations and negotiate land development conditions with developers to gain new BMPs during the plan review process. For proposed land developments and site improvements requiring a Runoff and Erosion Control Permit, the Township code sets a minimum standard of stormwater control that the developer must achieve. The plan review process also allows for negotiation of additional BMPs between the Township and the developer. However, this method of constructing BMPs to improve stormwater runoff controls relies on a decision by the property owner to take action and propose improvements. This opportunity to improve stormwater management on private property to help achieve community goals is infrequent. On the approximately 18,000 privately-owned parcels in Lower Merion, there were 43 subdivision or land development plans approved by the Township in 2016. To take advantage of these relatively infrequent opportunities to get new BMPs on private property, the Township should be prepared to clearly communicate with developers its vision for stormwater management at a site as soon as staff becomes aware of a proposal. This report discusses five opportunities the Township has to prepare to be in a position to influence the design of stormwater controls on land outside of their ownership:

• High Potential Stormwater Properties;
• Pollutant Trading;
• Infrastructure Partnering;
• Identification of Target Neighborhoods/Districts; and
• PennDOT Coordination.

High Potential Stormwater Properties
The Township should be proactive and create an inventory of parcels that have a high potential for treating stormwater on a regional scale. Regional stormwater management is promoted by the Stormwater Ordinance (§121.4.21) and could include managing runoff from one or two up-gradient parcels; or include comprehensive floodplain restoration to serve a watershed. Property owners who are aware that their parcel exists on this inventory will have knowledge of the
Township’s interest in potentially partnering with them on enhanced stormwater management on the site during the development plan review process.

We performed a desktop survey of the County parcel data to identify parcels that have high potential to reduce the rate and volume of stormwater runoff. We used search criteria for parcels that are located within 1/4-mile of a stream and are greater than two acres in size. Parcels with these characteristics are likely to include enough space and may have appropriate topography for placement of a stormwater BMP. Figure 1 below shows that 823 parcels in the Township fit these two criteria. Using County parcel data, we identified current land use (residential and non-residential). Residential land use is generally less likely to be redeveloped than commercial, institutional, or industrial land use; thereby having fewer opportunities to pursue new stormwater BMPs through the development process. Non-residential parcels are more likely to experience change in land use which could lead to proposed land development, triggering changes to stormwater management requirements.

Figure 1. High Potential Parcels in Lower Merion

Using the criteria employed in the analysis, 228 parcels have high potential for installation of BMPs that address stormwater management on a regional basis. We then split these non-residential parcels into those owned by the Township, the School District, and all others. Figure 2 presents the distribution of these parcels across the Township.

If the School District proposes site improvements triggering stormwater controls, the Township should request the opportunity to provide input and serve as a partner in the development proposal. For privately-owned properties, it is recommended that the Township define its priorities for regional BMPs that could apply on each site. These concepts should be consistent with the minimum standards for stormwater control as defined in the Township SALDO and Stormwater...
Ordinance while also identifying an opportunity for regional stormwater management. Negotiations with the developer for additional stormwater controls could include options where soils have high infiltrative capacity, where opportunities exist for receiving flow from off-site or the public ROW, or where highly efficient BMPs could reduce sediment discharge to local streams.

*Figure 2. Distribution of High Potential Parcels*

For example, the parcel presented in *Figure 3* (Bryn Mawr College’s Batten House on North Roberts Road) fits this preliminary definition of a high-potential parcel (<2 acres, near a stream). Even with the presence of the Township’s Floodplain District covering over half of the parcel, this institutional site has significant land area where improvements could occur. If the property owner were to propose improvements or changes to the site, the Township could identify potential stormwater controls that take advantage of topography, the existing riparian corridor, infiltrating soils (shown in green), and location down-gradient of relatively intensely developed residential and institutional land uses. Opportunity could exist to extend stormwater controls onto adjacent parcels under common ownership to capture runoff from other College properties, neighboring properties, and the public ROW.
Recommendations

- Establish an inventory of High Priority parcels that possess attributes conducive to regional stormwater management such as size, land use, location near streams, infiltrating soils, high depth to the water table, and topography.
- Define a stormwater management concept for each parcel that maintains the owner’s developability of the site, while designating areas of the site for preferred stormwater management controls.
- Communicate to each landowner the Township’s identification of their site as a High Potential parcel.
- Add these parcels to the Official Map or another list that triggers notification to Township staff to work with the landowner to promote the Township’s concept for using a portion of site for regional stormwater management.
- Define the Township’s policy for investing public resources on private property to achieve stormwater management goals.

Pollutant Trading

Pollutant trading to support water quality in Pennsylvania is permitted by the Pennsylvania Department of Environmental Protection (PADEP) specifically in the Chesapeake Bay watershed for nitrogen and phosphorus. Currently, point source discharges such as wastewater treatment plants are permitted to generate credits when they discharge less than their defined effluent limit. These facilities can request PADEP to verify and register credits to post on the market for trading to other point source dischargers who are not achieving their effluent limit.

Until 2013, agricultural operations were also permitted to register credit under the PADEP program. However, due to objections by USEPA related to how PADEP determined the baseline pollutant loading from these facilities, this program was suspended. Upon PADEP taking satisfactory action to define a program that establishes minimum discharge compliance standards...
required to be met prior to credit generation, BMPs addressing nonpoint sources will not be able to generate credits for trade.

Although there is a mechanism in Pennsylvania to trade nutrients between point sources (i.e. wastewater treatment plants) to improve water quality, Lower Merion’s pollutant of concern is sediment. There is currently not any mechanism to trade sediment between permittees to address sediment reduction responsibilities associated with an MS4’s Pollutant Reduction Plan. If a trading program were to take effect and receive authorization by PADEP, it would likely need to include the following features:

- **Defined pollutant limits.** The basis for most trading programs is a defined set of pollutant limits. Permittees that out-perform their responsibility to manage pollutants can generate credits; those that do not can elect to purchase credits or improve the management of their system so they can meet their effluent limit.

- **Geographic scale.** A trading system will need enough permittees with defined pollutant limits to create a market that includes both credit generators and purchasers. The geographic scale for such a market could vary, but generally, the larger, the better.
  - Local Watersheds. Only Narberth and Radnor flow into the Lower Merion. A credit program between these three permitted MS4s and any industrial stormwater permittees would provide only limited opportunities for trading.
  - Schuylkill Watershed. Although the Schuylkill River is not impaired by sediment, many municipalities in the watershed discharge to tributary to the Schuylkill for which sedimentation is the primary source of impairment. Therefore, Lower Merion may need to participate in, or even initiate, a conversation with other permittees in the watershed to promote a sediment trading program across the Schuylkill watershed.
  - Regional. Although only a few municipalities share stream networks with the Township, all the municipalities in Delaware County, Montgomery County, and eastern Chester County discharge to the Delaware Bay. A sediment trading program on this scale could include dozens of MS4 participants and even more industrial stormwater discharge permittees and agricultural operations. However, PADEP would likely need to see a commitment that sediment reductions would occur across the region and not be concentrated in any one area.

- **Verification and registration process.** PADEP will need to set standards for what type of sediment reduction projects and activities are creditable and the standards generators will need to meet in order to register them. Credits will need to be verified by an independent party prior to transfer of credits between the generator and the purchaser.

- **Operations and maintenance agreements.** Projects generating credit, such as streambank restoration or construction of a retention basin will need to be maintained so that their pollutant reduction capacity continues. Agreements between participants, with possible input from PADEP as a third party, will need to be documented so that sediment reductions are maintained.

- **Expiration and renewal schedules.** Depending on the sediment reduction practice, credits may expire or need to be renewed. This allows PADEP to adjust the credit program periodically and triggers an opportunity for all participants to review credits and make sure credit-generating practices are functioning as designed.

- **Trading ratios.** To quicken the pace of sediment reduction, PADEP may apply ratios to credit trading transactions. For example, a permittee purchasing credit may need to purchase multiple credits from a generator in order gain a single credit towards his pollutant reduction responsibility.
Pennsylvania legislators introduced Senate Bill 799 legislature in June 2017. Although, not specifically a trading program, SB 799 proposes a regional approach to pollutant management where both resources and compliance credit are shared. The bill would create a Pennsylvania Clean Water Procurement Program that will require contributions from MS4 permittees to fund pollutant removal BMPs needed to reduce pollutants flowing towards the Chesapeake Bay. SB 799 anticipates generating $50M annually for 10 years to fund projects that are most effective at reducing pollutant discharge. Similar to a trading mechanism, the Clean Water Procurement Program would encourage the flow of funding to those BMPs that were most effective towards a shared pollutant reduction goal. This concept would need to be translated to address sediment pollution in Lower Merion’s region, possibly the Schuylkill or Lower Delaware watersheds.

Recommendations
- Communicate with adjacent upstream communities (Radnor, Narberth) to investigate if there is an opportunity to cooperate on installation of a joint stormwater management BMP to control sediment discharge that could benefit both communities.
- Watch the progress of SB 799 to observe its progress through the legislature, proposed amendments, and its application to areas outside of the Chesapeake Bay watershed.
- Reach out to regional MS4 permittees about their interest in a collaborative approach to the PA Clean Water Procurement Program included in SB 799.
- Reach out to regional MS4 permittees about their interest in a regional sediment trading program in Southeastern Pennsylvania. If interest exists, discuss with PADEP and provide an outline of how the program could be established. Such a program may set the current 10% sediment reduction goal as a defined pollutant limit. Permittees over-achieving that responsibility could offer additional sediment reduction to other permittees in the region.

Infrastructure Prioritization
The 2016 Lower Merion Capital Improvement Program describes the Township’s planned investment in infrastructure and facilities from 2017 through 2022. The projects are organized into three categories as presented in Figure 4. The average investment across the three categories as presented in the Program is $7.5M annually.

Figure 4. Lower Merion’s Proposed Capital Improvements

<table>
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<tr>
<th>Plan Category</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>Annual Average</th>
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<tr>
<td>Service to People (Park Spaces)</td>
<td>$2,025</td>
<td>$3,746</td>
<td>$3,772</td>
<td>$1,297</td>
<td>$1,158</td>
<td>$3,060</td>
<td>$2.5M</td>
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<td>$1,025</td>
<td>$1,025</td>
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</tr>
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<td>$3,783</td>
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<td>$1,194</td>
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<td>$8,580</td>
<td>$5,891</td>
<td>$3,377</td>
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</tr>
</tbody>
</table>

*Except for Annual Average, all figures in $1,000s

While many of the proposed improvements focus on sanitary sewer and recreation, open and future projects should actively consider the Township’s stormwater management goals. This requires consultation between Lower Merion departments and offices, including Public Works, Shade Tree, Parking Services, Parks and Recreation, Building and Planning and the Environmental Advisory Council.
- For example, the Township has planned to invest $600K in basketball/ utility court reconstruction over the span of the Program. Resurfacing and reconstruction of these recreational facilities provides opportunities to install porous pavement and detention systems to manage stormwater.
Similarly, the Township’s proposed $6.3M investment in the Gladwyne/Villanova Area Sanitary Sewer Extension project in 2022 could be expanded to include the Green Stormwater Infrastructure (GSI) elements such as street trees and infiltration galleries in curb bump-outs. Although this project will be directed through the Sanitary Sewer Division of Public Works, an expanded scope to include GSI would include the Highway Division who would maintain new GSI elements, and the Building and Planning Department who would likely have a role developing a streetscape plan that fits the neighborhood.

While Lower Merion follows through with its own Capital Improvements Program, other entities in and around the Township are also implementing their capital plans. Communication with these potential partners is key to taking advantage of opportunities to work together with those that have are expecting to mobilize their resources to perform capital projects in the Township. A process to regularly communicate with the entities listed below should be developed to help the Township stay abreast of opportunities to perform joint projects.

- Aqua Pennslyvania;
- PECO Energy;
- PennDOT;
- Montgomery County; and
- Neighboring communities (Narberth Borough, Radnor Township, Haverford Township, City of Philadelphia).

In addition, private institutions and large developers sometimes propose medium and large scale improvements. These improvements may involve large areas of earth disturbance or the extension of sewer, water, storm, or telecommunications infrastructure within private property. The Township should communicate its intentions clearly with these entities to let them know that Lower Merion may be interested in working together on joint stormwater projects.

**Recommendations**
- Review proposed capital improvements for opportunities to include GSI while achieving the projects primary purpose.
- Integrate a review of GSI opportunities into all Township-sponsored capital improvements.
- Establish clear lines of communication with entities that may make capital investments in infrastructure in the Township.

**Identification of Target Neighborhoods/Districts**
Lower Merion’s SALDO and Stormwater Ordinance provide minimum standards for managing stormwater from new development to reduce the risk of flooding and protect water quality. However, to encourage new BMPs in already developed areas, the Township should focus on promoting higher stormwater management standards for infill and redevelopment projects. These standards should have a dual focus on 1) the types of development most prevalent over the past few years, and 2) the geographic areas of the Township experiencing the most development.

Between 2013 and 2016, the Township Board of Commissioners approved 166 land development plans. These plans created an additional 8.7 acres of impervious area within the Township. Not counted in this acreage are the additional 1,435 dwelling units approved for construction or the improvements not designated as land developments, but approved through Runoff and Erosion Control Permits and Grading Permits. The Township’s Pollutant Reduction Plan (PRP) calculates that there are approximately 1,050 acres of impervious area in the Township. Therefore, new development in from 2013 to 2016 increased impervious cover in the Township by over 1%. The Township should consider responding to these trends identified below by refining land
development regulations that promote a higher standard of stormwater management (i.e. standard to treat a greater water quality volume) from the types and location of development that are being proposed.

**Figure 5** summarizes the distribution of approved new impervious area and residential units across the development types as tracked by the Township. Institutional use made up nearly 40% of new impervious area, with construction at two private schools adding the most impervious area. However, the largest single addition of impervious surface was a Commercial use, a 59,000-square foot auto sales facility which made up 16% of all new impervious surface approved.

Although most new residential units were approved as residential-only projects, over 25% of new residential units were constructed as part of Mixed Use and Commercial developments.

**Figure 5. New Impervious Area and Residential Units by Development Type (2013 – 2016)**

![Bar chart showing distribution of new impervious area and residential units by development type](image)

**Figure 6** summarizes how new impervious area and residential units were distributed across zoning districts. 42% of new impervious area was approved in four of the Township’s residential districts (R1, R2, R3, and R4), primarily for auto sales and private education facilities. Approximately one third of all new non-residential impervious area was approved for construction in the either the CL or C2 Districts, with auto sales and retail land use being the largest contributors. The Bryn Mawr Village 4 District promotes mixed retail and residential land uses, resulting in 14% of the new impervious area approved in that district.

Only 5% of new residential units were constructed in the nine primarily residential districts (RAA, RA, R1, R2, R3, R4, R5, R6, and R6A). Residential land use in these districts appears to be relatively stable. The full number of house tear-downs is not captured in this figure as these do not require land development approval when only one home is involved.
In contrast to the number of approved residential developments in residential districts, 43% of new residential units were approved for construction in the M (Manufacturing and Industrial) District. The remaining 52% of the new residential units were constructed in the more densely developed R7, Ardmore Special Development, and City Avenue (Regional Center) Districts. This appears to support the construction trend that single family homes on individual lots (even at densities as high as 6,000 square feet per unit) are relatively uncommon when compared to the number of higher density dwellings and multi-family units constructed.

**Figure 6. New Impervious Area and Residential Units by Zoning District (2013 – 2016)**

![Graph showing new impervious area and residential units by zoning district.](image)

**Figure 7** presents how land development plans were distributed geographically across the Township. Note that many new developments were approved within the Lancaster Avenue and Conshohocken State Road corridors. **Figure 8** presents the land use categorization of the new impervious area approved between 2013 and 2016. In these four years, the most impervious area resulted from Retail and Mixed Retail land development applications (3.2 acres). However, auto sales facilities created the most new impervious area per proposal (0.7 acres each).
Figure 7. Location of New Impervious Area and Residential Units (2013 – 2016)

Figure 8. New Impervious Area by Land Use (2013 – 2016)

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Approvals</th>
<th>Total Sq Ft</th>
<th>%</th>
<th>Sq Ft/ Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail and Mixed Retail</td>
<td>8</td>
<td>139,353</td>
<td>37%</td>
<td>17,400</td>
</tr>
<tr>
<td>Private Education</td>
<td>6</td>
<td>104,585</td>
<td>28%</td>
<td>17,400</td>
</tr>
<tr>
<td>Auto Sales</td>
<td>3</td>
<td>93,430</td>
<td>25%</td>
<td>31,100</td>
</tr>
<tr>
<td>Public Education</td>
<td>4</td>
<td>31,136</td>
<td>8%</td>
<td>7,800</td>
</tr>
<tr>
<td>Other (Religious, Cemetery, Continuing care, Conservation)</td>
<td>4</td>
<td>8,145</td>
<td>2%</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>All Approvals</strong></td>
<td><strong>25</strong></td>
<td><strong>376,649</strong></td>
<td><strong>100%</strong></td>
<td><strong>15,100</strong></td>
</tr>
</tbody>
</table>

Recommendations

- Review impervious area caps in the districts experiencing the most growth (M, CL, C2, City Avenue, Bryn Mawr Village, and Ardmore Districts) to identify where these can be adjusted to promote new stormwater BMPs. For instance, impervious surface caps could be adjusted downward, while offering applicants the opportunity to increase the cap if they propose specific stormwater management or GSI elements.
- Prepare a design manual to address the Township’s preference for the types, location, and extent of stormwater management controls preferred in different districts. Special focus should be applied to applications proposing regional stormwater management, GSI, or stormwater management within the public ROW.
• Review land development regulations to identify opportunities to add stormwater BMPs through the land development process. The Township could add design standards or incentives for specific development types, with a focus on the following types of applications that are consistent with the most recent types of applications:
  o Land developments with greater than a defined square footage of new impervious area.
    ▪ 20% of approved non-residential land development applications proposed at least 25,000 sq ft of impervious surface.
  o Auto dealerships or applications proposing large areas of connected impervious surface.
    ▪ Standards to disconnect impervious surfaces within these large areas could prevent concentration of runoff and more effectively treat stormwater at the source of generation. Disconnection concepts could limit flowpaths for sheet flow, add depressed traffic islands or landscaping strips between parking spaces, and manage the loading ratio to stormwater controls.
  o Mixed use commercial proposals.
    ▪ These developments are often infill development where area for stormwater management is limited. Management concepts could encourage treatment of stormwater (including stormwater generated off-site) within the public ROW, where GSI concepts could achieve multiple benefits for the community. These concepts may need to be supported with resources from the Township for work in the ROW.
  o Residential developments with greater than a defined number of new units.
    ▪ This development type may be proposed in locations similar to Mixed Use Commercial development discussed above and benefit from the concept of moving stormwater management into the ROW. All approved applications proposing at least 30 new units occurred in high density districts (M, City Avenue, R7, Ardmore Special Development).

**PennDOT Coordination**

PennDOT operates under their own MS4 permit and is responsible for sediment reductions from their ROW and the areas that discharge to surface water through their outfalls. However, PennDOT typically does not control much area outside of their ROW on which they could install structural stormwater controls. Therefore, most of their opportunities to manage runoff are linear in nature, limiting the number and extent of opportunities to infiltrate stormwater and reduce sediment discharge. Partnerships facilitated by Lower Merion to extend linear BMPs beyond the PennDOT work area and outside the PennDOT ROW onto private property could yield regional stormwater BMPs and help achieve the Township’s water quality goals. PennDOT has communicated interest to partner and share credit with local communities on projects that treat pollutants from runoff and reduce sedimentation of local streams including bank erosion.

Many capital projects performed by PennDOT are funded through the Delaware Regional Planning Commission’s (DVRPC) Transportation Improvement Program (TIP). The TIP lists and prioritizes transportation projects throughout the nine county Philadelphia region in New Jersey and Pennsylvania and commits federal funding toward implementation. Although the projects in Pennsylvania that receive federal funds are often sponsored by PennDOT, they regularly bring in other state agencies, individual municipalities, SEPTA, Amtrak, and county governments as partners. Each of these stakeholders has the potential to be a partner with Lower Merion on a transportation project that may have a stormwater management component. Therefore, the Township should be prepared to communicate their stormwater management priorities for
portions of the regional transportation network and their commitment to partnering on local projects during the TIP nomination process.

Ten of the projects included on the 2017 – 2020 DVRPC TIP (July 27, 2017) occur all or partially within Lower Merion. Eight of these are active in 2017. Two are upcoming and one that is currently active is set to begin a new phase in 2023.

- **Ardmore Transportation Center.** Phase 1 is anticipated to begin in 2018 and will provide new structures, tunnel improvements, landscaping, and stormwater management. Phase 2 is slated for 2026 to include a parking garage and bus garage. Total project cost is $62M.
- **I-76 o/ Righters Ferry Rd Bridge.** Phase 1 of this project to rehabilitate the structurally deficient superstructure on I-76 over Righters Ferry Road wraps up in 2018, with construction beginning in 2020. Total project cost is $6.1M.
- **Belmont Road/Rock Hill Road Widening.** The current TIP includes $7.6M for adding lanes within this corridor and intersection and railroad overpass improvements. Looking out beyond the 2017 – 2020 TIP, DVRPC anticipates allocating another $31.6M through 2026.

**Recommendations**

- Review the current TIP for projects not yet in the design phase. Communicate to the sponsor Lower Merion’s vision for new stormwater BMPs applicable to those locations and assess if opportunities exist to partner on capital stormwater investment.
- Review future TIP timeframes for upcoming projects and submit GSI or stormwater management concepts to the sponsor. Potential sponsors could include PennDOT, SEPTA, Montgomery County, or others.
- Identify transportation corridors within which Lower Merion would like to see specific stormwater BMPs that help the Township pursue stormwater management goals. Develop conceptual stormwater management designs for specific sites to communicate stormwater BMP concepts to the sponsoring organization. Offer support of future applications to DVRPC for federal funding for implementation. Conceptual stormwater BMP areas could make use of area within the ROW as well as on to adjacent parcels.
Over the course of this stormwater planning process, Township leadership and the public identified a list of potential stormwater projects and services for consideration for addition to the Township’s current stormwater program. This report prioritizes these new projects and services, providing detail of the timing and extent of change to meet the Township’s stated objectives. This report serves as an outline of the Township’s next steps toward pursuing stormwater management goals and responsibilities in the next ten to twelve years.

This report presents five phases of the Township’s future stormwater program, developed through a process of interviews with staff and review of past studies, GIS mapping, MS4 progress reports, public input sessions, the Township Comprehensive Plan, and capital improvement plans. These phases build on documents previously delivered to the Township as part of this Comprehensive Stormwater Management Planning project, including:

- Minimum Control Measure Compliance Report
- Public Education Recommendations
- Illicit Discharge Detection and Elimination Recommendations
- Preferred Stormwater BMPs for Pollutant Reduction Goals
- Good House-Keeping Recommendations
- MS4 Mapping and Watershed Determinations Report
- TMDL Responsibility Report
- MS4 Mapping and Watershed Determinations Report and Pollutant Load Reduction Recommendations
- Recommended SALDO Updates Report
- Future Stormwater Opportunities Report

Program activities are divided into five phases that are based on timing of the MS4 regulatory cycle. Figure 1 summarizes the new or additional services recommended for the Township’s existing stormwater program. Township staff provided initial input on phases, priorities, and alternatives during meeting at the Township office on December 21, 2017 and January 9, 2018. Staff feedback is integrated into the figures below.

Phase 1 addresses the stormwater activities the Township will continue to perform as part of its ongoing stormwater program, plus new MS4 responsibilities beginning in 2018 to address the renewed permit effective in March 2018. Phases 2 through 5 present a ramp-up of the Township’s stormwater to take on additional compliance and infrastructure management services over the next ten years. These phases are intended to inform decisions on allocation of Township resources for stormwater services and establish the capital improvement plan to meet community goals for stormwater management.
**Figure 1. Proposed Additional Stormwater Services/Projects**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Proposed Additional Stormwater Services/Projects</th>
</tr>
</thead>
</table>
| Phase 1: 2018 | • Pollutant Reduction Plan – project design  
• Public Education strategy  
• Enhanced street sweeping  
• Land development ordinance updates                                      |
| Phase 2: 2019 - 2021 | • Pollutant Reduction Plan – construction  
• Storm sewer map update  
• Private BMP inspections  
• Storm sewer maintenance plan (development and implementation)  
• PCB control measure implementation  
• Green Stormwater Infrastructure Plan (development)  
• Drainage area study  
• Stormwater administrator (addition to staff)                                      |
| Phase 3: 2022 | • Develop a water quality monitoring program  
• MS4 permit renewal application  
• Design GSI project(s)  
• Storm sewer televideo program (development and implementation)                     |
| Phase 4: 2023 - 2026 | • Implement water quality monitoring program                                                                 |
| Phase 5: 2027 | • Fund GSI incentive program  
• Assess perflourinated compound sources                                                   |

**Figure 2** summarizes how annual stormwater program costs may change through each phase, organized into three cost centers: Capital Improvements, Operations & Maintenance, and Planning & Administration. The cost projection assumes that Lower Merion will continue to perform existing operational services at the current level (2017). Operations costs reflect an approximate 3% increase annually.

The projected cost to comply with the Township’s MS4 permit are also presented to demonstrate how the Lower Merion’s proposed investment in sediment reduction projects will impact the stormwater program. Streambank restoration projects and stormwater basin retrofits are already proposed through 2022; it is anticipated that Green Stormwater Infrastructure projects will be the focus of water quality capital projects to address MS4 requirements in the following phases.

**Figure 3** provides greater detail of each element of the stormwater program and applicable assumptions. Projects presented in Figure 3 are prioritized by Phase; the order of Services/Projects within each Phase is not prioritized. The table divides the cost for existing services from cost estimates for future or enhanced activities. *(Note: Highlighted items are awaiting additional information from Township records.)* Columns indicate if a cost element is required for compliance with the Township’s MS4 permit and elements for which the Township has flexibility for staffing new services with contracts or new Township personnel. With this information, leadership can adjust the priority status, timing, pace, and frequency of each element to be consistent with Township needs and regulatory requirements. Upon completion of prioritization, these phases will be included in the Comprehensive Stormwater Management Plan.

There are both known and unknown capital improvement needs and service gaps; this Projection presents a list of activities proposed for the future stormwater program based on current understanding of regulations and infrastructure condition. As Lower Merion implements its Comprehensive Stormwater Management Plan and the program matures, capital projects and
services will be adjusted and priorities will change as more information is captured about the Township’s stormwater responsibilities and the condition of the infrastructure network.

**Figure 2. Summary of Stormwater Program Costs**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Average Annual Cost</th>
<th>MS4 Req.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Investment</td>
<td>Operations &amp; Maintenance</td>
</tr>
<tr>
<td>Phase 1: 2018</td>
<td>$0.93M</td>
<td>$1.44M</td>
</tr>
<tr>
<td>Phase 2: 2019 – 2021</td>
<td>$1.88M</td>
<td>$1.63M</td>
</tr>
<tr>
<td>Phase 3: 2022</td>
<td>$1.82M</td>
<td>$1.77M</td>
</tr>
<tr>
<td>Phase 4: 2023 – 2026</td>
<td>$2.21M</td>
<td>$1.85M</td>
</tr>
<tr>
<td>Phase 5: 2027</td>
<td>$2.22M</td>
<td>$2.03M</td>
</tr>
</tbody>
</table>

![Bar chart showing the costs for each phase from 2018 to 2027.](chart.png)
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Service/Project</th>
<th>Description</th>
<th>Cost Assumptions</th>
<th>Annual Cost?</th>
<th>Cost Estimate</th>
<th>MS4 Req?</th>
<th>Service Provider for New Services (Contract/Twp Staff)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Operate and maintain existing storm sewer</td>
<td>Maintain current level of service provided by the Public Works Department related to storm response, leaf collection, and replies to citizen stormwater complaints. Include 40% of the Shade Tree Program ($1.4M annually), taking into account the benefits shade trees also provide, including increased property value, shading the urban heat island, and traffic calming.</td>
<td>40% of Shade Tree Prgm: $560K 2017 leaf collection costs: $140K 2017 stormwater complaint response costs: $67K</td>
<td>✓</td>
<td>$766K</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Install gray infrastructure capital improvements</td>
<td>Maintain current level of capital investment in storm sewer infrastructure consistent with the Township-Wide Stormwater Program.</td>
<td>Average annual cost of capital improvements ($8.1M over 11 years)</td>
<td>✓</td>
<td>$735K</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td>Perform minor storm sewer repair</td>
<td>Maintain current level of service provided by the Public Works Department related to minor storm sewer repairs (brick inlets, cross pipes, outfalls). All inlets are inspected and maintained on a 3 to 4-year cycle.</td>
<td>2017 inlet cleaning costs: $20K 2017 inlet repair costs: $410K</td>
<td>✓</td>
<td>$430K</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>1d</td>
<td>Comply with MS4 permit – 6 Minimum Control Measures (MCM)</td>
<td>Implement BMPs aimed at reducing pollutant discharge from the MS4 by implementing the 6 MCMs. Implement all 22 BMPs defined for the six MCMs, including definition of target audiences for public outreach, employee training, illicit discharge detection, good housekeeping, and documentation of each MCM compliance activity. Continue Township support of Lower Merion Conservancy’s efforts monitoring preservation areas, inspecting outfalls, and providing stormwater education. Pollutant Reduction Plan completed in 2017.</td>
<td>Contract engineer: $60K Planning, Public Works, and Administration Departments: 340 hours at $75/hr 85% of $30K contribution to LMC</td>
<td>✓</td>
<td>$110K</td>
<td>✓</td>
<td>NA</td>
</tr>
<tr>
<td>1e</td>
<td>Implement Pollutant Reduction Plan (PRP) – Design</td>
<td>Design and permit 20% of the streambank restoration projects (~2,000LF) and one of the two stormwater basin retrofits identified in the PRP submitted to PADEP.</td>
<td>Assume 15% of construction cost (refer to 2f)</td>
<td>✓</td>
<td>$190K</td>
<td>✓</td>
<td>Contract</td>
</tr>
<tr>
<td>1f</td>
<td>Develop public education strategy</td>
<td>In addition to MCMs 1 and 2 as defined by PADEP in the MS4 permit, develop a targeted, Township-led public education strategy. The strategy will be designed to raise awareness of stormwater issues throughout the Township and influence property owner’s behaviors managing runoff. Likely educational topics discussed during the public outreach phase of the Comprehensive Stormwater Management Planning process include:</td>
<td>Public Education Strategy development: $15K 4 interpretive signs at $1,200 each</td>
<td>✓</td>
<td>$20K</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>1g</td>
<td>Revise land development ordinances</td>
<td>In coordination with the Zoning Ordinance update and consistent with the Township Comprehensive Plan, revise the following prioritized sections of the Township code to better integrate the Township’s preferred stormwater management concepts into land use regulations:</td>
<td>Planning Department: 240 hours at $75/hr GSI Engineer: 80 hrs at $120/hr</td>
<td>✓</td>
<td>$28K</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Service/Project</td>
<td>Description</td>
<td>Cost Assumptions</td>
<td>Annual Cost?</td>
<td>Cost Estimate</td>
<td>MS4 Req?</td>
<td>Service Provider for New Services</td>
</tr>
<tr>
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</tr>
<tr>
<td>1h</td>
<td>Street sweeping</td>
<td>Lower Merion swept each Township road three times in 2017 using a broom sweeper. In 2018, two broom sweeping will be performed twice, with a third sweeping using a more effective regenerative air sweeper.</td>
<td>Begin transition from mechanical sweeping to more effective regenerative air sweeping.</td>
<td>✓</td>
<td>$160K</td>
<td>$40K</td>
<td>Contract</td>
</tr>
<tr>
<td>1i</td>
<td>Dedicate funding for vehicle and equipment replacement</td>
<td>Dedicate funding for the future repair, replacement, or purchase of equipment and vehicles for stormwater management. Requires additional accounting of current and projected use of vehicles used for stormwater services, replacement value of each vehicle, and vehicle lifespan.</td>
<td>2017 vehicle cost estimate for stormwater activities refer to 1a and 1c;</td>
<td>✓</td>
<td>$40K</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Average Annual Cost</td>
<td></td>
<td>$2.24M</td>
<td>$0.28M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2.52M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Service/Project</td>
<td>Description</td>
<td>Cost Assumptions</td>
<td>Annual Cost?</td>
<td>Cost Estimate Existing</td>
<td>New</td>
<td>MS4 Req?</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>-------------</td>
<td>------------------</td>
<td>-------------</td>
<td>------------------------</td>
<td>-----</td>
<td>----------</td>
</tr>
<tr>
<td>2a</td>
<td>Operate and maintain existing storm sewer</td>
<td>Refer to 1a.</td>
<td>✓</td>
<td>✓</td>
<td>$804K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td>Install gray infrastructure capital improvements</td>
<td>Reduce the average pace of gray infrastructure capital improvements (2006 to 2016) by one half. 50% decrease from historic spending averaging $735K annually</td>
<td>✓</td>
<td>✓</td>
<td>$368K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td>Perform minor storm sewer repair</td>
<td>Refer to 1c.</td>
<td>✓</td>
<td>✓</td>
<td>$452K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2d</td>
<td>Comply with MS4 permit – 6 Minimum Control Measures (MCM)</td>
<td>Refer to 1d.</td>
<td>✓</td>
<td>✓</td>
<td>$116K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2e</td>
<td>Implement Pollutant Reduction Plan (PRP) – Design</td>
<td>Design and permit 80% of the streambank restoration projects (~8,000LF) and the second stormwater basin retrofit identified in the PRP submitted to PADEP. Assume 15% of construction cost (refer to 2f)</td>
<td>✓</td>
<td>✓</td>
<td>$198K</td>
<td>✓</td>
<td>Contract</td>
</tr>
<tr>
<td>2f</td>
<td>Implement Pollutant Reduction Plan (PRP) – Construction</td>
<td>Install 80% of the streambank restoration projects (~8,000LF) and the first stormwater basin retrofit (remaining 20% of streambank restoration and 2nd basin to be installed in 2022). Streambank restoration: $450/LF (midpoint of $350 – $550/LF) Stormwater basin retrofit: $350K</td>
<td>✓</td>
<td>✓</td>
<td>$1.32M</td>
<td></td>
<td>Contract</td>
</tr>
<tr>
<td>2g</td>
<td>Add detail to the MS4 map</td>
<td>Collect attributes of each inlet and outlet (condition, size, material and invert elevation) that are part of the Township’s MS4. Inspect 1,800 inlets and 100 outfalls. 2-person crew, 30 features/day (520 hours at $90/hr; 520 hours at $25/hr)</td>
<td></td>
<td></td>
<td>$60K</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>2h</td>
<td>Inspect private BMPs</td>
<td>Inspect privately-owned stormwater BMPs to see if these features maintain their function as designed, approved, and installed. Assess the baseline condition of existing privately-owned BMPs. Develop a process to add new private BMPs to the inventory as they are constructed. Define the Township’s enforcement responsibilities, including inspection schedules and authority for taking action on issues of non-compliance.</td>
<td></td>
<td></td>
<td>$48K</td>
<td>✓</td>
<td>TBD</td>
</tr>
<tr>
<td>2i</td>
<td>Street sweeping</td>
<td>Perform three complete sweeps of Township streets using a regenerative air street sweeper. Complete transition from mechanical sweeping to more effective regenerative air sweeping.</td>
<td>✓</td>
<td>✓</td>
<td>$168K</td>
<td>$168K</td>
<td>Contract</td>
</tr>
<tr>
<td>2j</td>
<td>Dedicate funding for vehicle and equipment replacement</td>
<td>Refer to 1i.</td>
<td>✓</td>
<td>✓</td>
<td>$42K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2k</td>
<td>Storm Sewer Maintenance Plan</td>
<td>Develop a Storm Sewer Maintenance Plan that documents necessary actions to be performed to ensure long-term function and protection of assets (cleaning, repair, storm response, etc). Establish a process to input maintenance activities into the Township’s work order tracking database and review the plan annually to determine if updates are needed to the list of prioritized projects and activities and to plan for future funding needs.</td>
<td></td>
<td></td>
<td>$12K</td>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td>2l</td>
<td>Implement PCB Pollutant Control Measures</td>
<td>The Township included a set of Pollutant Control Measures (PCM) in its MS4 permit application to address the Schuylkill River’s impairment by PCB. PCMs to be performed 1) an inventory of suspected sources of PCB within the MS4 drainage area; 2) an investigation of each suspected source; 3) notification of PCB discharge to PADEP; and 4) documentation of progress of investigation.</td>
<td></td>
<td></td>
<td>$16K</td>
<td>✓</td>
<td>TBD</td>
</tr>
<tr>
<td>Item No.</td>
<td>Service/Project</td>
<td>Description</td>
<td>Cost Assumptions</td>
<td>Annual Cost?</td>
<td>Cost Estimate</td>
<td>MS4 Req?</td>
<td>Service Provider for New Services (Contract/Twp Staff)</td>
</tr>
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<td>-----------------------------------------------------</td>
</tr>
</tbody>
</table>
| 2m      | Develop GSI Plan with a Stormwater Design Manual | Develop a plan for applying the Township’s preferred GSI elements to Township properties, within the Township’s ROW, and private property through the development process. This document would define the Township’s:  
• Prioritized installation of GSI elements at specific Township facilities;  
• Operations and maintenance standards for the Township-owned GSI system;  
• Vision for integrating GSI into Township, County, and PennDOT ROW;  
• Preferred methods for designing, locating, installing, inspecting, and maintaining stormwater management infrastructure linked to land development regulations;  
• Incentives offered to private property owners to encourage investment in GSI (grants, loans, flexibility within land development regulations, etc);  
• Identified specific locations on private properties ideally suited for regional GSI elements;  
• The Township’s partnership strategy to work on private properties, including access, cost sharing, and maintenance agreements (refer to 5o).  

Additional GSI Plan elements could be added, such as consideration of climate change, its impacts on the MS4 and the stream network, and a strategy to adapt. Design Manual may include flow charts for review processes; typical designs for GSI; and GSI maintenance expectations. Range of costs for GSI Planning $80K to $250K. | Additional GSI Plan elements could be added, such as consideration of climate change, its impacts on the MS4 and the stream network, and a strategy to adapt. Design Manual may include flow charts for review processes; typical designs for GSI; and GSI maintenance expectations. Range of costs for GSI Planning $80K to $250K. | $100K | TBD | |
| 2n      | Perform drainage area study of priority watershed | Select a priority watershed for study and quantify the dynamics of flows through its streams and stormwater system. Define where problem areas are and to look upstream to identify causes and potential solutions. A hydrologic study of a priority drainage area would identify flow dynamics to develop capital improvement projects that take into account upstream land cover and downstream flow obstructions. | Hydrologic model of surface conveyance and closed conduit system for 1-sq mi drainage area | $60K | Contract | |
| 2o      | Administer stormwater program | Dedicate staff or contracted service to administer the multiple components of the Township’s stormwater program, such as:  
Capital Project Administration - Enhance capacity to administer capital projects associated with stream restoration, basin naturalization, and watershed studies (Staff capacity to manage procurement, contracts, and work orders may already exist in staff administering gray infrastructure capital projects).  
Education Strategy Implementation – Implement the Public Education Strategy and monitor the effectiveness of the education campaign and direct Township resources where they are most effective at raising awareness and changing behaviors.  
Compliance and Enforcement – Implement stormwater enforcement responsibilities (refer to 2h)  
Property Owner Response – Coordinate call logs and Township action taken addressing flooding and water quality concerns from residents and property owners to provide a consistent response and application of Township policies for action.  
Review Land Development Ordinances - Review land development codes for their consistency with the Stormwater Design Manual, the GSI Plan, the MS4 permit, and the Township’s water resources goals. Identify areas needing updates.  
Opportunity Planning – Coordinate opportunities for partnering with property owners to improve how stormwater is managed for the community may be missed during the land development plan approval process. Review land development plans for new development and re-development and coordinate proposed stormwater management controls to negotiate use of development to utilize sites for local or regional treatment of stormwater prior to discharge. Manage shared activities with the Lower Merion Conservancy.  
Mapping Updates – Direct the input and update of spatial data associated with stormwater features into the Township’s GIS.  
Public BMP Maintenance – Schedule the maintenance of Township stormwater controls, stream restoration projects, and GSI elements. | 1 new FTE administrative staff, fully loaded rate | $110K | TBD | |

Average Annual Cost | $1.95M | $1.89M | $3.84M |
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Service/Project Description</th>
<th>Annual Cost?</th>
<th>Cost Estimate</th>
<th>Cost Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>Operate and maintain existing storm sewer system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3b</td>
<td>Install gray infrastructure capital improvements (OMC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3c</td>
<td>Comply with MS4 permit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3d</td>
<td>Design PRQ/GSI project (refer to 2m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3e</td>
<td>Operate and maintain existing storm sewer system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3f</td>
<td>Implement Pollutant Reduction Plan (PRP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3g</td>
<td>Develop a water quality monitoring program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3h</td>
<td>Prepare MS4 Permit Notice of Intent and PRP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3i</td>
<td>Street sweeping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3j</td>
<td>Dedicate funding for vehicle and equipment replacement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3k</td>
<td>Televideo storm sewer system cleaning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3l</td>
<td>Administer stormwater program</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Cost Estimate**

- **Annual Cost?**
- **Cost Estimate**
- **Cost Assumptions**
- **Service Provider for New Services**

**Average Annual Cost**

- **$2.09M**
- **$1.94M**
- **$4.03M**
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Service/ Project</th>
<th>Description</th>
<th>Cost Assumptions</th>
<th>Annual Cost?</th>
<th>Cost Estimate</th>
<th>MS4 Req?</th>
<th>Service Provider for New Services (Contract/Twp Staff)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a</td>
<td>Operations and Maintenance</td>
<td>Refer to 2a</td>
<td>✓</td>
<td>✓</td>
<td>$870K</td>
<td>NA</td>
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<tr>
<td>4b</td>
<td>Gray infrastructure capital improvements</td>
<td>Refer to 2b</td>
<td>✓</td>
<td>✓</td>
<td>$397K</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>4c</td>
<td>Minor system repairs</td>
<td>Refer to 1c</td>
<td>✓</td>
<td>✓</td>
<td>$488K</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>4d</td>
<td>MS4 Compliance – 6 Minimum Control Measures (MCM)</td>
<td>Refer to 1d</td>
<td>✓</td>
<td>✓</td>
<td>$125K</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>4e</td>
<td>Implement Pollutant Reduction Plan (PRP) - Design</td>
<td>Design 80% of PRP elements submitted to PADEP in 3Q 2022, including 6,000LF of streambank restoration projects, 12 stormwater basin retrofits/GSI projects (refer to 3g) (remaining 20% designed in 2022 - refer to 3b).</td>
<td>Assume 15% of construction cost (refer to 4f)</td>
<td>✓</td>
<td>✓</td>
<td>$194K</td>
<td>Contract</td>
</tr>
<tr>
<td>4f</td>
<td>Implement Pollutant Reduction Plan (PRP) – Construction</td>
<td>Install 80% of the streambank restoration projects, stormwater basin retrofits, and GSI projects (remaining 20% to be installed in 2027 - refer to 5f).</td>
<td>Streambank restoration: $600/LF Stormwater basin retrofit/GSI project: $375K</td>
<td>✓</td>
<td>✓</td>
<td>$1.62M</td>
<td>Contract</td>
</tr>
<tr>
<td>4g</td>
<td>Inspect private BMPs</td>
<td>Inspect 20% of privately-owned stormwater BMPs annually.</td>
<td>Assume 100 total BMPs require full inspection. Inspect 20 private BMPs; 2-person crew, 4 features/day (80 hours at $90/hr)</td>
<td>✓</td>
<td>✓</td>
<td>$8K</td>
<td>TBD</td>
</tr>
<tr>
<td>4h</td>
<td>Street sweeping</td>
<td>Refer to 3i.</td>
<td>✓</td>
<td>✓</td>
<td>$182K</td>
<td>$182K</td>
<td>Contract</td>
</tr>
<tr>
<td>4i</td>
<td>Dedicate funding for vehicle and equipment replacement</td>
<td>Refer to 2m.</td>
<td>✓</td>
<td>✓</td>
<td>$45K</td>
<td>NA</td>
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<tr>
<td>4j</td>
<td>Administer stormwater program</td>
<td>Refer to 2o.</td>
<td>✓</td>
<td>✓</td>
<td>$119K</td>
<td>TBD</td>
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<tr>
<td>4k</td>
<td>Televideo storm sewer system</td>
<td>Refer to 3k.</td>
<td>✓</td>
<td>✓</td>
<td>$87K</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>4l</td>
<td>Implement water quality monitoring program</td>
<td>Implement water quality monitoring program defined in 3f.</td>
<td>✓</td>
<td>✓</td>
<td>$80K</td>
<td>TBD</td>
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<tr>
<td>4m</td>
<td>Perform drainage area study of priority watershed</td>
<td>Refer to 2n.</td>
<td>✓</td>
<td>✓</td>
<td>$60K</td>
<td>Contract</td>
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</tr>
</tbody>
</table>

Average Annual Cost: $2.11M / $2.30M / $4.41M
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Service/Project</th>
<th>Description</th>
<th>Cost Assumptions</th>
<th>Annual Cost?</th>
<th>Cost Estimate</th>
<th>MS4 Req?</th>
<th>Service Provider for New Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a</td>
<td>Operations and Maintenance</td>
<td>Refer to 2a</td>
<td>$896K</td>
<td>✓</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5b</td>
<td>Gray infrastructure capital improvements</td>
<td>Refer to 2b</td>
<td>$409K</td>
<td>✓</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5c</td>
<td>Minor system repairs</td>
<td>Refer to 1c</td>
<td>$30K</td>
<td>✓</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5d</td>
<td>MS4 Compliance – 6 Minimum Control Measures (MCM)</td>
<td>Refer to 1d</td>
<td>$129K</td>
<td>✓</td>
<td>✓</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5e</td>
<td>Design PRP/GSI project</td>
<td>Consistent with the GSI Plan (refer to 2m), design 20% of the GSI elements required by the 2028 MS4 permit and PRP (refer to 5j).</td>
<td>Assume 15% of construction cost (refer to 4f)</td>
<td>✓</td>
<td>$194K</td>
<td>✓</td>
<td>Contract</td>
</tr>
<tr>
<td>5f</td>
<td>Implement Pollutant Reduction Plan (PRP) – Construction</td>
<td>Install 80% of the streambank restoration projects, stormwater basin retrofits, and GSI projects (remaining 80% installed in Phase 4 – refer to 4f).</td>
<td>Assume 15% of construction cost (refer to 4f)</td>
<td>✓</td>
<td>$1.62M</td>
<td>✓</td>
<td>Contract</td>
</tr>
<tr>
<td>5g</td>
<td>Dedicate funding for vehicle and equipment replacement</td>
<td>Refer to 2m</td>
<td>$47K</td>
<td>✓</td>
<td>NA</td>
<td>NA</td>
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</tr>
<tr>
<td>5h</td>
<td>Televideo storm sewer system</td>
<td>Refer to 4k</td>
<td>$215K</td>
<td>✓</td>
<td>TBC</td>
<td>TBC</td>
<td></td>
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<tr>
<td>5i</td>
<td>Implement water quality monitoring program</td>
<td>Refer to 4l</td>
<td>$82K</td>
<td>✓</td>
<td>TBC</td>
<td>TBC</td>
<td></td>
</tr>
<tr>
<td>5j</td>
<td>Prepare MS4 Permit Notice of Intent and PRP</td>
<td>Refer to 3g</td>
<td>$80K</td>
<td>✓</td>
<td>Contract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5k</td>
<td>Administer stormwater program</td>
<td>Refer to 2o</td>
<td>$123K</td>
<td>✓</td>
<td>TBD</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>5l</td>
<td>Perform drainage area study of priority watershed</td>
<td>Refer to 2n</td>
<td>$65K</td>
<td>✓</td>
<td>Contract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5m</td>
<td>Inspect private BMPs</td>
<td>Refer to 4g</td>
<td>$8K</td>
<td>✓</td>
<td>TBD</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>5n</td>
<td>Street sweeping</td>
<td>Refer to 3i</td>
<td>$187K</td>
<td>✓</td>
<td>$187K</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>5o</td>
<td>Fund GSI incentive program</td>
<td>Consistent with the GSI Plan (refer to 2m), designate funds to offer as an incentive to private property owners to install stormwater management BMPs on their property.</td>
<td>✓</td>
<td>$50K</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5p</td>
<td>Revise land development ordinances</td>
<td>Continue to refine stormwater standards as informed by the GSI Plan, land development trends, water quality monitoring program and PRP implementation.</td>
<td>Planning Department: 240 hours at $85/hr GSI Engineer: 80 hrs at $125/hr</td>
<td>✓</td>
<td>$30K</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>5q</td>
<td>Assess perflourinated compound sources</td>
<td>Perflourinated compounds (PFCs) are an emerging contaminant of concern. PFCs were added to products to add features to help resist heat, oil, stains, grease, and water. NPDES permittees may in the future need to address sources of this pollutant, similar to how PCBs are addressed now.</td>
<td>Contract engineer: 160 hours at $100/hr</td>
<td>✓</td>
<td>$16K</td>
<td>TBD</td>
<td></td>
</tr>
</tbody>
</table>

Average Annual Cost: $2.25M - $2.59M

$4.84M
Stormwater Program Projection Notes:
Average annual cost for the Operations and Maintenance Cost Center in Phases 2 through 5 of Figure 7 of this Comprehensive Stormwater Management Plan is lower by approximately $140K compared to the Stormwater Program Projection (01/17/2018). This reduction is due to the current expectation that contracted street sweeping using mechanical brush sweeping will continue to be the Township’s preferred approach.

The Planning and Administration Cost Center in Phases 3 through 5 of Figure 7 of this Comprehensive Stormwater Management Plan is $60 - $80K compared to the Stormwater Program Projection (01/17/2018). This reduction is due to the decrease in the extent and scope of proposed water quality monitoring program.
Appendix B
Public Presentations and Notes

- Stakeholder Session, October 30, 2017 – Presentation and Notes
- Public Session, November 20, 2017 – Presentation and Notes
- Commissioners Presentation, January 24, 2018 – Presentation
Comprehensive Stormwater Management Plan

Stakeholder Session
Lower Merion Township
October 30, 2017

Nathan Walker, AICP
Senior Water Resources Planner

Elizabeth Treadway, PWLF
Principal Program Manager

751 Arbor Way, Ste 180
Blue Bell, Pennsylvania 19422
610 828-8100

Stakeholder Session

We want to hear from you:
► Is the Township doing enough now to manage stormwater in your neighborhood?
► What should the Township’s water priorities be to meet current and upcoming challenges?
► What resources should the Township invest to protect streams and maintain storm sewers?

Today’s Agenda:
1. Stormwater management in Lower Merion
2. Your response to current services
3. Future Township stormwater responsibilities
4. Your input on priorities
5. Next steps
Planning Goals

**Comprehensive Plan Recommendation W8**
Develop a more comprehensive Township-wide stormwater management plan to guide the development and implementation of innovative methods to efficiently and economically manage municipal stormwater.

- Review current stormwater management activities
- Document current and future stormwater needs across the community
- Identify the Township’s tools for managing stormwater
- Define which tools are most useful - looking out 5, 10, and 15 years
- Present Board of Commissioners with findings

---

Development impact on stormwater runoff

**FIGURE 4.2 WATER CYCLE**
Before development almost all rainfall is taken up by plants, evaporates or infiltrates through the ground. After conventional development, surface runoff increases significantly while evaporation and infiltration into the ground decreases.

Image courtesy of [Source of Image](image-url)
## Delaware River Watershed

Lower Merion Township

## Local Watersheds

<table>
<thead>
<tr>
<th></th>
<th>Lower Delaware River</th>
<th>Schuylkill River</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>4 sq mi</td>
<td>20 sq mi</td>
</tr>
<tr>
<td>Stream Length</td>
<td>3 mi</td>
<td>41 mi</td>
</tr>
<tr>
<td>Tributaries</td>
<td>Cobbs, Hardings, Indian, Meadowbrook Valley</td>
<td>Arrowmink, Gulley, Gulph, Mill, Sawmill, Trout</td>
</tr>
<tr>
<td>Storm Inlets</td>
<td>1,500</td>
<td>3,000</td>
</tr>
<tr>
<td>Storm Sewer</td>
<td>33 miles</td>
<td>69 miles</td>
</tr>
<tr>
<td>Storm Outfalls</td>
<td>125</td>
<td>450</td>
</tr>
</tbody>
</table>
Land Cover

- Open Water
- Developed, Open Space, <20%
- Developed, Low Intensity, 20 - 49%
- Developed, Medium Intensity, 50 - 79%
- Developed, High Intensity, >80%
- Undeveloped
- Forest

USGS, National Land Cover Database

Water Quality Status

Legend:
- Waterbody
- Waterbody Source

Map area of aquatic life use.
Water Quality Status

Aquatic Habitat in Mill Creek
What does the Township accomplish now?

► Storm sewer cleaning and repair
► Street sweeping
► Pre/post storm clean up
► Leaf collection
► Water quality permit compliance
► Land development plan review
► Construction site inspections
► Stormwater control inspection tracking
► Public Works master planning
► Resident response
Township-Wide Stormwater Program

Purpose:
► Investigate the reports of flooding;
► Identify the cause and extent of the flooding;
► Identify potential solutions;
► Establish recommended priorities for further action.

Township-Wide Stormwater Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Fund</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>2006</td>
<td>$950,000</td>
<td>$774,000</td>
</tr>
<tr>
<td>2007</td>
<td>$1,590,000</td>
<td>$1,803,000</td>
</tr>
<tr>
<td>2008</td>
<td>$4,180,000</td>
<td>$4,057,000</td>
</tr>
<tr>
<td>2009</td>
<td>$4,666,000</td>
<td>$2,208,000</td>
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<tr>
<td>2010</td>
<td>$6,000,000</td>
<td>$3,361,000</td>
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<tr>
<td>2011</td>
<td>$867,000</td>
<td>$692,000</td>
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<tr>
<td>2012</td>
<td>$600,000</td>
<td>$744,000</td>
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<tr>
<td>2013</td>
<td>$600,000</td>
<td>$899,000</td>
</tr>
<tr>
<td>2014</td>
<td>$600,000</td>
<td>$800,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$7,260,000</td>
<td>$5,989,000</td>
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<tr>
<td>AVERAGE</td>
<td>$806,667</td>
<td>$767,667</td>
</tr>
</tbody>
</table>

11-Year Total: $8.1M

2015 | $597,000 |
2016 | $575,000 |
Land Use Regulations

► Subdivision and Land Development Ordinance (SALDO)
► Natural Features Conservation Code
► Stormwater Management and Erosion Control Ordinance
► Zoning Ordinance

<table>
<thead>
<tr>
<th>Use</th>
<th>Second Stage Plan</th>
<th>Waiver Plan</th>
<th>Amendment Plan</th>
<th>Preliminary Subdivision</th>
<th>Tentative Sketch</th>
<th>Preliminary Land Development</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>9</td>
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<tr>
<td>Single-Family</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
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<td>Mixed-Use</td>
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<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Commercial</td>
<td>0</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>25</td>
</tr>
</tbody>
</table>

Comprehensive Plan

► 13 Recommendations & Strategies
  ► Regulatory Code (7)
  ► Infrastructure (3)
  ► Retrofits/Education (3)
Stakeholder Session

We want to hear from you:
► Is the Township doing enough now to manage stormwater in your neighborhood?
► What should the Township’s water priorities be to meet current and upcoming challenges?
► What resources should the Township invest to protect streams and maintain storm sewers?

Lower Merion’s Upcoming Challenges

Example of issues occurring Township-wide:
► Aging pipes
► Undersized infrastructure
► Street flooding
► Floodplain management
► Areas underserved by storm sewers
► Preference for Green Stormwater Infrastructure
► Private property issues
► Pennsylvania water quality regulations
  ► MS4 Permit
Short Term Priority – MS4 Compliance

► Municipal Separate Storm Sewer System (MS4) permit issued in 2003
► Federally driven water quality protection permit
► Sets minimum standards for the Township to:
  ► Map and inspect storm sewers
  ► Provide public education and involvement opportunities
  ► Define water quality controls for land development applications
  ► Good housekeeping at municipal facilities

Short Term Priority – MS4 Compliance

► Pollutant Reduction Plan (PRP)
  ► 10% reduction of sediment discharge
    ► Schuylkill Watershed: 150 tons/year
    ► Lower Delaware Watershed: 125 tons/year
► Achieve sediment reduction goal by March 2023
  ► Perform 20% of implementation tasks annually for 5 years
(PRP) Two Miles of Stream Restoration

(PrP) Basin Retrofits
Stakeholder Session

We want to hear from you:
► Is the Township doing enough now to manage stormwater in your neighborhood?
► What should the Township’s water priorities be to meet current and upcoming challenges?
► What resources should the Township invest to protect streams and maintain storm sewers?

Examples of issues occurring Township-wide:
► Aging pipes
► Undersized infrastructure
► Street flooding
► Floodplain management
► Areas underserved by storm sewers
► Preference for Green Stormwater Infrastructure
► Private property issues
► Pennsylvania water quality regulations
  ► MS4 Permit

Available Stormwater Management Tools

Short-Term
► Stream restoration
► Basin retrofits

Mid- to Long-Term
► Hydrologic modeling
► Equipment purchases
► Storm sewer inspection, operations, and maintenance
► Specific Plans
► Official Map
► Capital Improvement Plan
► Green practices on public property
► Education
► Partnerships - regional and private
► Sustainable funding source
► Stormwater Design Manual
► Code updates
Stormwater Design Manual

- States the Township’s preferred methods for managing stormwater
  - Location
  - Design
  - Low Impact Development
  - Green Stormwater Infrastructure
  - Inspection schedules
  - Operations and maintenance plan

Rain Gardens and Vegetated Swales

Source: USEPA
Land Use Regulations

- Subdivision and Land Development Ordinance (SALDO)
- Natural Features Conservation Code
- Stormwater Management and Erosion Control Ordinance
- Zoning Ordinance

Available Revisions

- Adjusted thresholds for triggering stormwater management
- Defined site design process
- Incentives for regional stormwater management
- As-buils and documentation of sediment reductions
- Special controls for:
  - Hot spots or industrial use
  - Infill development
  - Riparian corridors and natural features
- Adjusted impervious surface caps
- New landscaping standards for green stormwater infrastructure and parking lots

Stakeholder Session

We want to hear from you:

- Is the Township doing enough now to manage stormwater in your neighborhood?
- What should the Township’s water priorities be to meet current and upcoming challenges?
- What resources should the Township invest to protect streams and maintain storm sewers?
Thank You

More to say?
Submit statements to:
► Robert Duncan, Assistant Township Manager, RDuncan@lowermerion.org
► Andrea Campisi, Senior Planner, ACampisi@lowermerion.org

Upcoming tasks:
► Summary of Stakeholder Response
► Public Meeting
  ► November 20 @ 6:30
► Draft Comprehensive Stormwater Management Plan
► Presentation to Board of Commissioners
Feedback from Attendees:

1. Question: Does the Township look holistically – balancing impervious area with open space; is there a goal in mind?

2. Use outfall controls to improve runoff water quality.

3. Floodplain Management:
   a. Velocity is excessive during rainfall events.
   b. Property damage is the responsibility of the homeowner now; are there instances where the Township takes responsibility?
   c. Public investment should be considered on private property to address floodplain management conditions.

4. Increase use of green infrastructure to help treat the water – to drop out sediment.

5. Use Township areas as pilot projects and make this a priority.

6. Question: Is the Philly model transferable to the Township? Using grants and incentives to private property owners as partners in addressing water quality? Consideration should be given to establishing a program that encourages partnerships.

7. Question: Do development standards target minimizing impervious area? Changes should be considered to address and encourage GSI.

8. Incentives for use of GSI (tradeoffs for use):
   a. Time of processing permits and review? Perhaps standards can be set by the Township that reduce developer costs and time when using GSI.
   b. Permitting standards: When using predetermined GSI designs, for example, can the permitting process be simplified?

9. Construction Site Management and post construction inspections:
   a. Is compliance happening? Does the Township have data on issues and repeat offenders?
   b. What are the consequences of non-compliance? There is anecdotal evidence of non-compliance – how is the Township addressing failures? What is the frequency of inspection? Can the Township improve inspections to address concerns?

10. The School District should be a key partner for the Township. They need to follow the rules; install GSI where appropriate; use GSI as teaching opportunities for all grades; perhaps provide higher density development at school sites with the tradeoff of increased GSI controls on site.

11. Open space preservation is important objective and supports long-term stormwater needs in the Township.
12. Montgomery Avenue:
   a. Impacting downstream properties and streams.
   b. Erosion issues are occurring in receiving streams (Mill Creek is a good example).
   c. Township should study this area to reduce downstream impacts.

13. BMP installation is important goal for Township to address water quality. Understanding where to site and how impacts can be measured should be part of long-term plan. Township should be retrofitting public land wherever possible as part of overall plan.

14. Regulations may not be strong enough to address problems. Consider tightening regulatory requirements for development.

15. There is an awareness that developments did not have to comply on parcels when impervious area is 100% on a property. Were not required to address conditions on site. This should not be allowed.

16. New zoning requirements may be needed to support improvement in water quality.

17. Impervious area creep: This is a problem – where increased impervious area is occurring without permits or approvals. Who is responsible for oversight? Who should be contacted when it occurs? (answer – contact Bob; also Planning Department).

18. Current threshold for permitting development is 1500 square feet of additional impervious area. Shouldn’t any change in imperviousness be permitted? The cumulative impacts can be serious.

19. Township needs to be careful with over control of development and impervious area because it can lead to making land unusable (undevelopable). Everyone needs to comply with regulations but over-regulating can have serious impacts to owners.

20. One key issue that should be addressed is the responsibility assigned to the Township for public drainage systems that cross private land. Responsibility should be clear and policies should be in place so that private landowners know the limits of their liability as well as the Township taking responsibility when appropriate.
Comprehensive Stormwater Management Plan

Public Session
Lower Merion Township
November 20, 2017

Nathan Walker, AICP
Senior Water Resources Planner

Kwabena Addo-Boateng, PE, LEED-AP
Senior Project Manager
751 Arbor Way, Ste 180
Blue Bell, Pennsylvania 19422
610 828-8100

Public Session

We want to hear from you:
► Is the Township doing enough now to manage stormwater in your neighborhood?
► What should the Township’s water priorities be to meet current and upcoming challenges?
► What resources should the Township invest to protect streams and maintain storm sewers?

Today’s Agenda:
1. Stormwater management in Lower Merion
2. Your response to current services
3. Future Township stormwater responsibilities
4. Your input on priorities
5. Next steps
Planning Goals

Comprehensive Plan Recommendation W8
Develop a more comprehensive Township-wide stormwater management plan to guide the development and implementation of innovative methods to efficiently and economically manage municipal stormwater.

► Review current stormwater management activities
► Document current and future stormwater needs across the community
► Identify the Township’s tools for managing stormwater
► Define which tools are most useful - looking out 5, 10, and 15 years
► Present Board of Commissioners with findings

Development impact on stormwater runoff
Delaware River Watershed

Local Watersheds

<table>
<thead>
<tr>
<th></th>
<th>Lower Delaware River</th>
<th>Schuylkill River</th>
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<tbody>
<tr>
<td>Drainage Area</td>
<td>4 sq mi</td>
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<td>Stream Length</td>
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<td>125</td>
<td>450</td>
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</tbody>
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Land Cover

USGS, National Land Cover Database

Water Quality Status
Water Quality Status

Aquatic Habitat in Mill Creek
What does the Township accomplish now?

- Storm sewer cleaning and repair
- Street sweeping
- Pre/post storm clean up
- Leaf collection
- Water quality permit compliance
- Land development plan review
- Construction site inspections
- Stormwater control inspection tracking
- Public Works master planning
- Resident response
Township-Wide Stormwater Program

Purpose:
► Investigate the reports of flooding;
► Identify the cause and extent of the flooding;
► Identify potential solutions;
► Establish recommended priorities for further action.

Township-Wide Stormwater Program

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11-Year Total: $8.1M

2015 | $597,000 |
2016 | $575,000 |
Land Use Regulations

► Subdivision and Land Development Ordinance (SALDO)
► Natural Features Conservation Code
► Stormwater Management and Erosion Control Ordinance
► Zoning Ordinance

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<th>Amendment Plan</th>
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<th>Tentative Sketch</th>
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Comprehensive Plan

► 13 Recommendations & Strategies
  ► Regulatory Code (7)
  ► Infrastructure (3)
  ► Retrofits/Education (3)
Stakeholder Session

*We want to hear from you:*

► Is the Township doing enough now to manage stormwater in your neighborhood?
► What should the Township’s water priorities be to meet current and upcoming challenges?
► What resources should the Township invest to protect streams and maintain storm sewers?

Lower Merion’s Upcoming Challenges

*Example of issues occurring Township-wide:*

► Aging pipes
► Undersized infrastructure
► Street flooding
► Floodplain management
► Areas underserved by storm sewers
► Preference for Green Stormwater Infrastructure
► Private property issues
► Pennsylvania water quality regulations
  ► MS4 Permit
Short Term Priority – MS4 Compliance

- Municipal Separate Storm Sewer System (MS4) permit issued in 2003
- Federally driven water quality protection permit
- Sets minimum standards for the Township to:
  - Map and inspect storm sewers
  - Provide public education and involvement opportunities
  - Define water quality controls for land development applications
  - Good housekeeping at municipal facilities

Pollutant Reduction Plan (PRP)
- 10% reduction of sediment discharge
  - Schuylkill Watershed: 150 tons/year
  - Lower Delaware Watershed: 125 tons/year
- Achieve sediment reduction goal by March 2023
  - Perform 20% of implementation tasks annually for 5 years
(PRP) Two Miles of Stream Restoration

(PRP) Basin Retrofits
Stakeholder Session

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  ► Green Stormwater Infrastructure
  ► Inspection schedules
  ► Operations and maintenance plan

Rain Gardens and Vegetated Swales

Source: USEPA
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We want to hear from you:
► Is the Township doing enough now to manage stormwater in your neighborhood?
► What should the Township’s water priorities be to meet current and upcoming challenges?
► What resources should the Township invest to protect streams and maintain storm sewers?
Input from Stakeholders:

**Regulatory Codes**
- Follow the lead of the Comprehensive Plan
- Coordinate stormwater management, Zoning updates, and incentives
- Transfer development rights away from sensitive areas
- Develop a stormwater design manual with a catalogue of designs
- Provide flexibility on impervious cover caps
- Adjust the development threshold triggering stormwater management
- Review the Township’s enforcement of stormwater control installation and maintenance
- Regulations should not be overly restrictive on development

**Infrastructure**
- Lead by example and use GSI to improve water quality
- Partner with large landowners and the school district
- Perform hydrologic modeling of local watersheds

**Retrofits/Education**
- Educate the public (GSI, Reduced chemical use, Natural landscaping)
- Develop process to improve water quality from runoff from highly developed areas
- Define stormwater responsibilities on private property
- Minimize use of salt as a de-icer

Thank You

**More to say?**
Submit statements to:
- Robert Duncan, Assistant Township Manager, RDuncan@lowermerion.org
- Andrea Campisi, Senior Planner, ACampisi@lowermerion.org

Upcoming tasks:
- Summary of Stakeholder Response
- Draft Comprehensive Stormwater Management Plan
- Presentation to Board of Commissioners
Meeting Notes  
Lower Merion  
November 20, 2017  
Public Meeting

Feedback from Attendees:

1. Focus on sustainable approaches or Green Stormwater Infrastructure (GSI) as an alternative to traditional conveyance and control.
   a. Where can deliberate use of GSI replace the need for large investments in gray infrastructure.

2. Expand the use of no-mow zones around streams at Township parks and facilities.

3. Public education campaign with strategies towards:
   a. Rain gardens in residential areas
   b. Stormwater controls on large properties
   c. Sale of rain barrels
   d. Keep leaves out of the stream
   e. Promotion of Conservancy stormwater assessment service
   f. Proper maintenance of shade trees, natural landscaping, reduction of lawn chemicals
   g. Operations and maintenance of stormwater infrastructure
   h. Interpretative signage that explains function of GSI


5. Complete map of stormwater infrastructure, including inventory of storm sewer size, age, and condition.

6. Update land development policies to address the type of development occurring (infill, tear-downs, etc).

7. Provide property owners with incentives for planting trees, reducing use of turf chemicals, landscape naturalization, installation of GSI.

8. Monitor stormwater controls to make sure they function and are maintained after installation.
   a. Residential properties
   b. Large properties

9. Incorporate flexible design standards to address climate change.

10. Consider the use of a stormwater fee to fund Township initiatives.

11. Perform hydrologic modeling to better understand flow dynamics in watersheds.
    a. Use USACE or grant funds where available.
Development impact on stormwater runoff

**Figure 4.2 Water Cycle**

Before development, almost all rainfall is taken up by plants, evaporates or infiltrates through the ground. After conventional development, surface runoff increases significantly while evaporation and infiltration into the ground decrease.
Land Cover

What does the Township accomplish now?

► Storm sewer cleaning and repair
► Street sweeping
► Pre/post storm clean up
► Leaf collection
► Water quality permit compliance
► Land development plan review
► Construction site inspections
► Stormwater control inspection tracking
► Public Works master planning
► Resident response
Stormwater planning in Lower Merion

1997 2004, with updates 2016 2017

Results of stormwater planning

**Completed and Ongoing Activities:**
- Land use regulation updates
- Capital investment in drainage infrastructure
- Public outreach and education
- MS4 permit compliance
- Outfall monitoring with Lower Merion Conservancy

**Upcoming:**
- Streambank restoration
- Stormwater basin retrofits
- Long range stormwater management strategies

**Comprehensive Plan Recommendation W8**
Develop a more comprehensive Township-wide stormwater management plan to guide the development and implementation of innovative methods to efficiently and economically manage municipal stormwater.
Data gathering process

File review
► MS4 Permit records
► Pollutant Reduction Plan
► Land use regulations

Site visits
► County Line Road
► Koegel Complex
► Mill Creek Station

Staff input
► Building and Planning
► Public Works
► Administration
► Parks

Public Input
► Environmental Advisory Council
► Public meetings

Public session questions:

*We asked the public:*
► Is the Township doing enough now to manage stormwater in your neighborhood?

► What should the Township’s water priorities be to meet current and upcoming challenges?

► What resources should the Township invest to protect streams and maintain storm sewers?
The public’s response:

► Champion Green Stormwater Infrastructure (GSI)
  ► Water quality education
  ► Public investment in GSI
  ► Coordinate GSI through the development process
  ► Offer incentives for private property owners

► Refine land use codes
  ► As a tool to encourage GSI and regional stormwater management
  ► To ensure consistent application and enforcement

Lower Merion’s Upcoming Challenges

Example of issues occurring Township-wide:

► Aging pipes
► Pennsylvania water quality regulations
  ► MS4 Permit
► Undersized infrastructure
► Street flooding
► Floodplain management
► Areas underserved by storm sewers
► Preference for Green Stormwater Infrastructure
► More complex infrastructure maintenance needs
► Private property issues
**Lower Merion’s Upcoming Challenges**

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**Lower Merion’s Upcoming Challenges**

[Image of river with map overlay]
Recommendations

- Continue infrastructure operations and maintenance
- Implement Pollutant Reduction Plan

- Formalize stormwater program
- Evaluate stream health, water quality, and maintenance activities
- Pivot to Green Stormwater Infrastructure

Direct investment in “innovative methods to efficiently and economically manage municipal stormwater” towards:
- Improved stream health
- Sustainable infrastructure management

Recommended Activities

<table>
<thead>
<tr>
<th>Phase</th>
<th>Proposed Additional Stormwater Services/ Projects</th>
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<tbody>
<tr>
<td>Phase 1: 2018</td>
<td>Pollutant Reduction Plan – project design, Public Education strategy, Enhanced street sweeping, Land development ordinance updates</td>
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<tr>
<td>Phase 2: 2019 – 2021</td>
<td>Pollutant Reduction Plan – construction, Storm sewer map update, Private BMP inspections, Storm sewer maintenance plan (development and implementation), PCB control measure implementation, Green Stormwater Infrastructure Plan (development), Drainage area study, Stormwater administrator (addition to staff)</td>
</tr>
<tr>
<td>Phase 3: 2022</td>
<td>Develop a water quality monitoring program, MS4 permit renewal application, Design GSI project(s), Storm sewer televideo program (development and implementation)</td>
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<tr>
<td>Phase 4: 2023 – 2026</td>
<td>Implement water quality monitoring program</td>
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<tr>
<td>Phase 5: 2027</td>
<td>Fund GSI incentive program, Assess perflourinated compound sources</td>
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Thank You

Upcoming tasks:
► Draft Comprehensive Stormwater Management Plan
► Presentation to Board of Commissioners

Nathan Walker, AICP
Senior Water Resources Planner

Alex Carroll
Water Resources Engineering Professional